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GAS AND ELECTRIC COMPETITION FOR BOSTON STREET LIGHTING.

Some interesting comparisons of gas and electric lighting have just preceded the contract, just executed, for 500-watt magnetite street lamps in Boston.

For the first time in probably a quarter of a century the gas company has made a serious attempt to compete with arc lamps on the main streets, and this attempt has failed.

Two types of gas lamps were offered in competition with the old 500-watt direct-current enclosed arcs that Boston has had on its streets for about ten years, and also with the new 500-watt magnetite arcs covered by the new contract.

One high-pressure gas lamp was erected on West Street, and it appears that an offer was made to erect such lamps on Boston Common, but these latter never appeared. According to the results of a test published by the superintendent of streets, the West Street lamp yields about thirty candlepower per cubic foot of gas consumed per hour, instead of the seventy-three candles per foot claimed by the gas company.

A more extended effort was made by the gas company on Commonwealth Avenue, where sixteen Graetzin lamps were erected on either side of the street, from Arlington to Berkeley. Each of these Graetzin lamps is understood to consume seven cubic feet of gas per hour, and yields 100 candlepower at twenty degrees below the horizontal, according to a test published by the superintendent of streets, or less than fifteen candles per cubic foot of gas per hour. These lamps are of the inverted type, each has two mantles, and they are fitted with large reflectors, so that all of the light is confined to the lower hemisphere.

Commonwealth Avenue is 200 feet wide, with a parkway in the center, and the block from Arlington to Berkeley Street, like the adjoining block between Berkeley and Clarendon streets, is 640 feet long. As there are eight of the Graetzin lamps on each side of Commonwealth Avenue in the block from Arlington to Berkeley Street, they are a little more than eighty feet apart.

In the next block, from Berkeley to Clarendon Street, there are five of the 500-watt magnetite arc lamps of the type covered by the new contract for Boston street lighting, along Commonwealth Avenue. By standing at either corner of Commonwealth Avenue and Berkeley Street, a block illuminated by sixteen Graetzin gas lamps may thus be seen in one direction, and a block illuminated by five magnetite arc lamps of 500 watts each in the other direction. Standing at the point just indicated, it

was evident to the unaided eye that a much greater general illumination was produced by the electric lamps, though the gas lamps distributed their light somewhat more evenly, due to the short spaces between them.

This conclusion as to the much greater illumination with the electric arcs is amply supported by the published tests of the superintendent of streets, which show a total of 7,500 candlepower for the five arc lamps and 1,600 candlepower for the sixteen Graetzin gas lamps, or nearly five times as much light from the electric source.

In price the greater amount of electric illumination is cheaper than the less amount with gas, for, under the new contract, the arc lamps cost the city $103.54 each, and the gas lamps are offered at $35 each, annually. These prices amount to a yearly total of $517.70 for the five arc lamps and $560 for the sixteen gas lamps.

Tests reported by the superintendent of streets show only about thirteen candlepower per cubic foot of gas per hour for the single mantle Welsbach gas lamps, of which Boston has more than 10,000 in use, and the rates for tungsten street lamps under the new contract should displace most of these mantle burners.

POWER STATION OUTPUT AND PRODUCTION ECONOMY.

The more one studies the economics of electric power production the more apparent becomes the influence of total output at the busbars on the efficiency of station generating processes. It is not too much to say that the load factor of a station is perhaps the most important of all the conditions bearing on operating cost. Comparisons of production cost under diverse conditions show that very frequently a plant equipped with old apparatus will respond in a most satisfying way to bettered load factors, although it is obviously difficult to attain the same economy that is the natural portion of a thoroughly modern installation. An illustration of what may be done in an old plant by increase of output, and particularly by development of the motor load on a central station, is afforded by the results of the past three years in a 600-kilowatt station, located in eastern Massachusetts. This plant will probably be discontinued and changed into a substation of a modern steam-turbine, alternating-current system, as the cost of production is still rather high, but its recent history is suggestive in relation to cost reduction through increased load, and this in the face of a progressive rise in the price of coal.

In the year 1906 the equipment of the plant consisted of 600 horsepower of Kendall and Roberts boilers, 725 horsepower of Ball and McIntosh and Seymour compound condensing engines and 300 kilowatts in General Electric generators. The boilers, four in number, were equipped with Hawley down-draft furnaces, and there were three engines, driving two dynamos by the "outlawed" line shaft and belt method. Two engineers and two firemen operated the station, these four men constituting the entire staff of the plant. The cost of coal in 1906 was $4.04 per ton delivered at the station, and the total fuel bill for the year was $3,815. The cost of labor was $5,741. Oil and waste, water and repairs brought the total cost of manufacture to $10,593. The plant generated during the year 357,257 kilowatt-hours, making the production cost per unit 2.96 cents. In this year the company sold 279,683 kilowatt-hours, of which 42,888 units were delivered to customers for the operation of electric motors. Thus only a small proportion of the output was sold for power service. The fuel cost per kilowatt-hour generated was 1.07 cents, and the labor cost 1.61 cents. The total unit cost was plainly too high, and it is interesting to note what occurred in the next year, when by various changes in conditions and expansion of business the plant more than doubled its output and increased its power sales almost seven-fold.

In 1907 the plant retained the same boilers and engines, but added a 300-kilowatt generator to its equipment. One engineer was added, making the total operating force five men. The cost of coal per ton this year was $4.33, an increase of eight per cent over 1906. The plant turned out 799,315 kilowatt-hours, at its switchboard, sold 587,703 kilowatt-hours, and delivered of the latter 282,645 kilowatt-hours for motor service. The fuel cost per kilowatt-hour generated fell off a little, to 0.995 cent; but the greatest saving occurred in the labor item, per kilowatt-hour, which fell to 0.50 cent. The other items of cost were of little consequence. The total cost of manufacture was $14,080, or 1.76 cents per unit, a reduction of 1.2 cents per kilowatt-hour from the figures of the preceding year, and a most telling example of what happens to the labor cost in a station when the machinery is operated at vastly improved outputs. It is significant that the fuel economy of the station did not show radical improvement, since the type of machinery in the plant, or rather the station design, did not illustrate the best modern practice. It is evident that while some fuel savings may be expected in an old plant whose load factor is improved, more is to be expected from the labor account. The repair records of this station show that no unusual care was bestowed on the equipment, or else that the station was fortunate in having few if any breakdowns. In two of the three years considered the total steam and electric plant maintenance was less than $500, and in the other year this figure came to only $1,000.

For the year 1908, the station showed a slight further gain in economy of production. The energy generated was 976,544 kilowatt-hours, and the total cost of generation $16,131, or 1.65 cents per unit. The labor cost per unit remained at 0.50 cent, while the fuel cost rose slightly, to 1.05 cents. The coal cost per ton this year was $4.59, and the total fuel bill $10,247. The operating force of the plant was increased by the addition of a coal passer, the total power plant payroll now including six men. There was no change in boiler, engine or generator equipment. In 1908 the company sold 593,873 kilowatt-hours, of which 298,143 kilowatt-hours were used by motors.

The foregoing data indicate that a rise of 14.5 per cent in the price of coal and an increase of fifty per cent in the number of men on the payroll of the station during the three years were far more than offset by the improvement of conditions which

surrounded the machinery and the plant personnel when the output was so notably increased. Doubtless further economies might have been secured if the character of the plant had warranted the company to consider replacing some of the older machines with modern direct-connected units. The wisdom of such a policy, however, could not be determined from a simple inspection of the manufacturing records of the station; in order to ascertain whether the plant should be improved or abandoned, the questions of first cost, depreciation and other fixed charges would have to be considered. From the fact that the plant will shortly be superseded it is evident that the best efficiency possible lies along other lines. Few points are more often emphasized in these days than the value of the motor load in a central station of any size, but the opportunities which still confront the central-station engineer and manager justify repeated reference to the subject, particularly when the results of a remarkably progressive policy become apparent in the detailed figures of station operating cost.

THE DAY OF THE TROLLEY LINE.

In common with other states, Illinois is fast being covered with a network of electric railways, interurban or through routes. Tapping hitherto almost inaccessible rural districts, through freight and passenger rates are being established with the great steam railway systems. Only the other day the Illinois Traction System obtained direct and indirect access to the 14,000 miles of the Rock Island-Frisco lines by a joint tariff arrangement covering the transportation of all classes of freight between stations on both systems.

The quick, close competition of the trolley has forced the hands of the steam railways, and the state authorities, in many instances, recognizing the handwriting on the wall, have made demands on the older railway companies that they meet the connecting and competing trolley lines on equal terms.

It is the day of the trolley line.

A week or so ago two experts who were giving evidence as to the value of a proposed new trolley line and the needs of the territory it was intended to serve, stated that it was largely a question of carrying freight, in particular from truck farms, and added that as far as country electric lines were concerned the profits mainly depended upon the amount of freight handled.

This is, in fact, the very basis of the matter.

It is the development of the country, the increase in land values from the greater ease and rapidity with which the centers of population may be reached by out-of-the-way rural communities that bring about the finally paying passenger traffic.

It is the ability to deliver the produce of the farms, in particular truck and fruit farms, quickly to the city that has increased the value of land in the rural districts, for the demand in the towns for vegetables, berries and the like at reasonable prices is always greater than the supply. Therefore the greater the convenience in handling rural freight, the greater the benefit to the city and the greater the value of the land reached by the trolley line.

WORKING THE PRESS.

At a time when such powerful and reputable papers as the Chicago *Tribune* and Boston *Transcript* have most commendably declined to accept certain flamboyant financial advertisements and are inclined to look carefully into all such promulgations, it is very much the duty of the technical press to be even more careful.

News items, so called, interesting in themselves as stories, of the results of this or that invention are often sent in and, it is to be regretted, published and then afterward quoted by stock promoters as being what such a well-known journal says.

Today and every day hundreds of fake schemes and impracticable propositions are being put before the public in tempting guise. Only here and there are any really worthy projects to be found among the lot. For example, many wireless systems are being exploited at this time which have very little prospect of commercial future. Even companies that are accomplishing a good deal in a scientific and partly practical way are being used in the stock jobbing game.

At the last Electrical Exposition held in Chicago half the boys who came along had some private wireless system or another that, of course, "worked all right and only needed advertising" to be the wonder of a waiting world. These were innocent enthusiasts. But there are, it is to be regretted, thousands of grown-up schemers who are not.

Let the technical and reputable trade press refuse to be "worked" and let the daily press exercise such care as has been noted, and there will be less work for the postal inspectors and the United States courts, while the public will certainly be more cheerful if not quite so wise.

CIVIC IMPROVEMENTS AND THE CENTRAL STATION.

It is with pleasure that we call attention to the Conference on City Planning and Municipal Art in New York city, described on another page of this issue, for it is a subject which is of great importance to us as individuals and as representatives of a great industry; moreover, an industry which affects the health and comforts of millions of our citizens to a greater extent than any other private enterprise with the exception of its older brother, the gas industry.

Both the gas and electric interests of New York city have given freely of their resources to make the exhibit a success, as becomes public service corporations. The time has passed when corporations could not see that it was to their own advantage, as well as that of the public, to aid movements looking toward the improvement of civic conditions.

Municipal ownership has probably seen the zenith of its success, such as it was, but municipal supervision is but in its infancy, and fortunately it brings many of the virtues and few of the evils of its predecessor. Let us come forward and show our good works, and encourage our people to state proudly that "they are citizens of no mean city." The problem left is to find the most convenient source of electric power for such systems.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

OFFICIAL PROGRAMME FOR 1909 CONVENTION, ATLANTIC CITY, JUNE 1, 2, 3 AND 4.

The following programme has been officially announced for the convention of the National Electric Light Association to be held at Atlantic City, N. J., June 1, 2, 3 and 4:

TUESDAY, JUNE 1—10:00 A. M.

First Session—President's Address. Announcements. Report of Committee on Uniform Accounting. Report of Committee on Progress," T. C. Martin, New York. Paper, "Private Policy," Paul Lüpke, Trenton. Report Question Box Committee. Report of Committee on State and Company Branches, R. M. Searle, Rochester.

TUESDAY, 8:30 P. M.

Second Session—Opening Address. Paper, "Latest Developments in Street Lighting," J. W. Cowles, Boston. Paper, "Methods of Manufacture of Incandescent Lamps, Carbon, Metallized, Tantalum and Tungsten," showing by samples various processes, S. E. Doane, Cleveland. Illustrated Lecture, "Quality of Light," Paul Bauder, Cleveland.

WEDNESDAY, JUNE 2—10:00 A. M.

Third Session — Manufacturers' Day. Paper, "Advanced Information Regarding Developments in Storage Batteries," Joseph Appleton, Electric Storage Battery Company. Paper, "The Regenerative Flame Lamp," A. J. Mitchell, the Adams-Bagnall Electric Company. Paper, "The Status of the Arc Light," H. R. Birge, General Electric Company. Paper, "Recent Types of Arc Lamps and Their Operation," C. E. Stephens, Westinghouse Electric and Manufacturing Company. Discussion on the last three papers. Report, Committee on Meters, G. R. Green, Philadelphia. Paper, "Future Requirements of Central-Station Companies," P. Torchio, New York. Paper, "Some Recent Developments in Electrical Apparatus," E. W. Allen, General Electric Company. Paper, "Distributing Transformers as of Interest to Central Stations," E. G. Reed, Westinghouse Electric and Manufacturing Company. Discussion on the two previous papers.

WEDNESDAY—8:30 P. M.

Fourth Session — Executive, Report of Treasurer, John F. Gilcarist, Chicago. Report of Committee on Public Policy, Samuel Insull, Chicago. Report of Lamp Committee, W. W. Freeman, Brooklyn. Report of Insurance Expert, William H. Blood, Jr., Boston. Appointment of Nominating Committee.

THURSDAY, JUNE 3—10:00 A. M.

Technical Session — Report, Committee on Gas Engines, J. B. Klumpp, Philadelphia. Paper, "Some Features of Condenser and Cooling-Tower Design and Operation," M. R. Bump, New York. Paper, "The Use of Reactance Coils in Generating Stations," P. Junkersfeld, Chicago. Paper, "Unique Features in Power-Plant Design," G. L. Knight, Brooklyn. Paper, "All-Day Efficiency Tests on Station Transforming Apparatus," F. M. Farmer, New York. Paper, "Transformers," W. A. Layman. Paper, "Low-Pressure Steam Turbines," C. H. Smoot, New York.

THURSDAY—2:30 P. M.

Technical Session — Report, Committee on Grounding Secondaries, W. H. Blood, Jr., Boston. Report, Committee, Protection from Lightning and Other Static Disturbances, B. E. Morrow, Albany. Discussion on first two papers of morning session. Report, Committee, Overhead Line Construction, Paul Spencer, Philadelphia. Paper, "Recent Developments in Secondary Distribution Work," W. K. Vanderpoel, Newark. Paper, "Requirements and Specifications for Extra High Potential Transmission Lines," A. S. Ives, Poughkeepsie. Discussion on third, fourth and fifth papers of morning session. Paper, "Performance Specifications and Ratings," W. L. Waters, Pittsburgh. Paper, "Central Stations in Towns of Less Than Four Thousand People," J. S. Knowlson, Schenectady.

Municipal Art and City Planning Exhibit in New York City.

The exhibit on Municipal Art and City Planning which opened on May 3 for a two weeks' stay at the armory of the Twenty-second Regiment, New York city, is being conducted on somewhat different lines from other similar exhibits of the past. The principal difference lies in the fact that public lighting fixtures with which New York city abounds, there being some 75,000 within its confines, are given a prominent place.

There has been no attempt at elaborate decoration of the hall, which is laid out with a central court of honor, wheer meetings are held, surrounded by five aisles devoted to displays of maps, photographs, etc. The general lighting is supplied by flaming-arc lamps, with tungsten lamps for local lighting.

The street-lighting exhibit has been arranged along historical lines, beginning with the old sperm oil lamp upon a wooden post, the flat flame gas lamp equipped with square lanterns, which superseded the oil lamps in New York, beginning with 1823 and finally in 1860, is next in line. After these comes the open-flame naphtha, which was brought out in 1877, and the mantle gas and mantle naphtha brought out in 1896 and 1898, respectively.

Among the electric lamps one of the early high-tension Brush open-arc equipments is shown and the regular city fixtures are placed about the room. Both carbon and tungsten incandescent lamps are shown on iron posts, the latter being the regular equipment. Several models of proposed types of tungsten posts are also shown. This exhibit was made possible by the active co-operation of Charles F. Lacombe, chief engineer of light and power, department of water supply, gas and electricity.

In addition to the fixtures there has been gathered and well arranged as fine a set of photographs of actual installations as has probably ever been presented. The majority have been furnished by the New York Edison Company, showing the fixtures about the city. There are also a large number taken in most of the large cities of Europe, and the claims made for artistic foreign productions along these lines are well substantiated.

Practically the whole of the exhibit in the armory is in photographs, maps, diagrams, paintings, etc., and it is hard to say which is deserving of the attention, but the collection loaned by John D. Crimmins of old prints, showing New York in the early days, is excellent in every respect.

The Illuminating Engineering Society has two booths containing an exhibit of ornamental street lighting fixtures which is not in any sense complete, representative nor particularly praiseworthy.

The purpose of the exhibit is to interest the public in civic improvements, and it has the support of some of the city's most prominent citizens. One or two meetings are held every day, being free to the public. The subjects discussed include the following:

"The Importance of City Planning," "The Educational Side of the City's Development," "Municipal Art," "Streets and Street Fixtures and Parks," "The Economic Aspects of City Planning."

Although art plays an important part in the conference, the fact that it is good business for a city to build along lines which are æsthetic as well as utilitarian is being forcibly shown. In this connection it may be of interest to know that a series of lectures was given last winter under the auspices of the Board of Education at its largest center on "The Architecture of the Great Cities of the World," by Professor Hamlin, of Columbia University, and the most telling point which he brought out was the fact that the famous European municipalities had all found it good business to make their cities beautiful. No building of any prominence has been erected in Venice for a hundred years, whereas the average life of buildings in New York city was less than forty years. When monumental buildings are erected in Paris, streets and boulevards are opened to give the site the proper vista.

The subject of congestion is probably the most vital of all those with which this new-made metropolis has to deal. Much has been accomplished through the recent tenement-house law, but curiously enough the things which the city is striving to rid itself of in Manhattan are appearing in the outlying portions of the other boroughs.

The Proposed Merger of Chicago's "L" Roads.

Last week Ira M. Cobe, Emile K. Boisot and Samuel Insull, who have been working as a committee on plans for the merger of Chicago's elevated railway companies, submitted a proposition to the executive committees of the four companies, the South Side Elevated Railroad, the Northwestern Elevated Railroad, Chicago & Oak Park Elevated Railroad and Metropolitan Elevated Railroad.

Briefly, it is proposed to merge the four companies named in a lease-operating company to be known as the Central Terminal Company, with outright purchase of the Union Loop Company. Through routes, single fare, improved service and more light under the loop structure are the attractions held out to the public in return for popular support of the enterprise. To the stockholders of the companies it is proposed to merge there are offered fixed dividends and well-kept-up properties—a good tenant at a fair rent promptly paid every quarter.

In financial terms it amounts to this: The Central Terminal is to have at least $4,000,000 cash paid-in capital, to be used in construction, equipment or other property needed in its business; the Union Loop is to be bought in from the Northwestern Elevated Company by a bond issue; an amount equal to four per cent on the preferred stock of the Northwestern is to be paid the first year of the lease, and thereafter five per cent and increasing amounts until $350,000 a year is reached. It rests with the joint owners of the Northwestern and Oak Park roads to settle how the money received as rent from the Central Terminal Company shall be apportioned on the stock of the respective roads. A lump sum not yet specified is to be paid the Metropolitan on somewhat the same terms; and to the South Side Elevated Company an annual payment on the capital stock of that company, of three per cent a year for two years (amounting to $300,000 per annum), then four per cent for two years, then four-and-one-half per cent for five years, and thereafter five per cent.

The Central Terminal Company will receive as owners of the Union Loop one-half cent on every passenger carried and the profits over and above the rentals specified, and to the promoters, some of whom are prominently identified with Chicago central-station power interests, there will be the certainty of furnishing all the companies with all of their power, that is to say, all the power needed by the Central Terminal Company.

Mr. Insull, president of the Commonwealth Edison Company, has been one of the most active movers in this proposition for a merger of the "L" roads, and the wider the scope of his electric company's power-supplying operations the greater the saving to all who use the central-station power. It is merely another economic, common-sense proposition and a practical necessity tending to the public weal. As far as the elevated companies are concerned, it is likely to remove the causes of poor operation and the kind of half-hearted, ill-conducted and illogical competition which has hitherto existed, and which has been brought about by the present loop complications.

The Central Terminal Company is to have an issue of preferred and common stock with a bonded indebtedness created in payment for the loop. The preferred stock will represent the cash put in, and the common, in part, a bonus to the promoters.

Canada's Inducements for South African Trade.

Julius G. Lay, United States Consul-General at Cape Town, furnishes the following information concerning the efforts being made for the enlargement of Canadian trade in South Africa:

The Elder Dempster Line of steamships, running from Montreal to South African ports, and subsidized by the Canadian government, is offering free passage to commercial travelers, merchants or manufacturers who are endeavoring in a bona fide manner to further Canadian export trade to South Africa. This steamship line has regular steamers for South Africa, one each month, and, when cargo warrants it, occasional intermediate steamers. These steamers are fitted up with cold storage.

While, according to the subsidy contract, the steamers are not allowed to touch at any American port on their outward voyage except for coaling, nevertheless large quantities of cargo shipped through Canada are being brought out for American manufacturers.

The representative of the line at Cape Town has been interviewed and expresses the opinion that if the American manufacturers sending out goods by way of Canada desire to obtain the same facilities for their travelers as are given to the Canadian firms, it could be arranged by communicating with the shipping company's head office in Montreal.

Unique San Francisco Franchise.

A street-railway franchise, unique in the history of San Francisco, has been authorized by the Board of Supervisors. Provisions safeguarding the eight-hour day, a twenty-five cents per hour minimum wage, a $3 wage for platform men by agreement, the purchase of the road by the city after fifteen years with any "franchise" valuation stricken out, and liberal lighting concessions to the city were incorporated in the measure before passage to print.

The route is over Stockton Bay and other streets to the Presidio. It involves a tunnel in Stockton, between Sutter and Sacramento, and a bond of $50,000 to protect the city against damages.

Enormous Postal Business.

The number of letters and post-cards sent through the postal system of the United States is given as 6,466 millions in 1907, as against 3,263 millions handled by the postal service of the German Empire, 3,359 millions by the postal service of the United Kingdom, 1,119 millions in France, and 1,067 millions in Austria-Hungary. The telegraph messages sent in the United States numbered nine millions in 1870, twenty-nine millions in 1880, sixty-three millions in 1890, eighty millions in 1900, and ninety-eight millions in 1907.

Electric-Railway Theatre Trains.

The Chicago and Milwaukee Electric Road has put into service a daily theatre train between Milwaukee and Chicago for the benefit of Milwaukee people who may desire to attend Chicago theatres. The express train leaves Milwaukee about six o'clock in the evening, arriving in Chicago at eight o'clock, and leaving that city at about midnight, arrives in Milwaukee at two in the morning. A buffet car for serving late lunches may be attached to the train.

Iron-Ore Supply of the United States.

The available iron-ore supply of the United States is estimated at 4,785,000,000 long tons, and the production of iron ore from the mines of the United States in the year 1907 was 52,000,000 tons, the largest total ever produced in a single year. The pig iron produced in the country in the same year of 1907 is shown to have been 25,781,000 long tons, while the world's production of pig iron in that year is given by accepted authorities at 60,500,000 long tons.

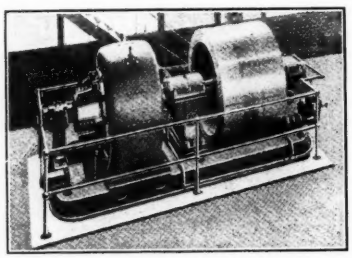
A WELSH ELECTRIC HOISTING PLANT.

BY A. H. BRIDGE.

Among the most important electric mining installations carried out in recent years in the United Kingdom is that which is operating in South Wales, at the Maritime Pit of the Great Western Colliery Company. Its leading interest lies in the fact that it includes the first electric hoisting machine of moderate capacity in South Wales, and, for the matter of that, in the United Kingdom, being required to hoist 175 tons of coal per hour from a depth of 1,100 feet in seventy lifts.

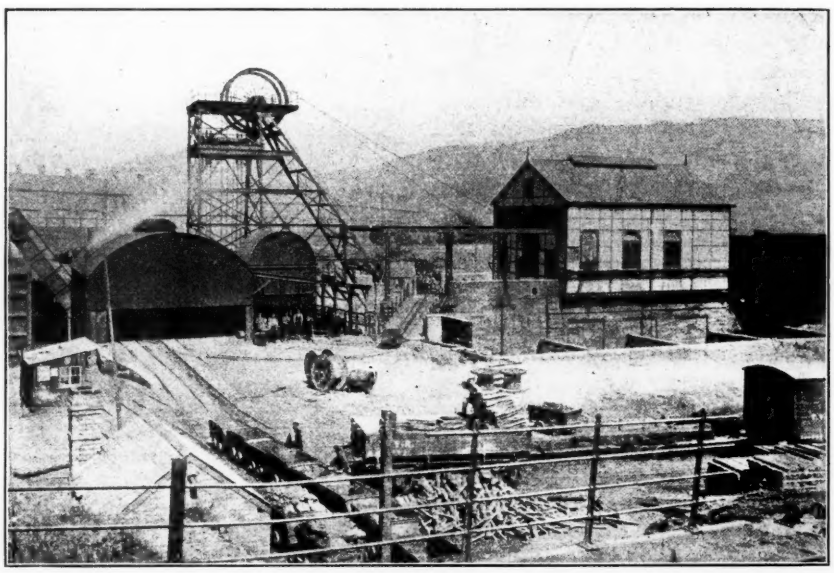
G. H. J. Hooghwinkel, to whom the author is indebted for the illustrations which accompany the following notes, says that the increasing value of small coal in South Wales and the decreased cost of electric power are points which, during recent years, have altered conditions in favor of electric hoisting. He says that in comparing the cost of electric with steam hoisting the cost of coal and electricity is the main point to be considered; the higher the selling value of the small coal used, the better the case for electricity. The fuel costs of a steam hoisting plant are between fifty and sixty per cent of the total annual costs, tending to approach the higher figure. In the power station, however, the fuel costs are much lower, and should not be more than forty per cent, so that the higher value of coal used has a much smaller effect. Mr. Hooghwinkel says that electric hoisting by itself on a large scale apart from the colliery equipment is not economical, and is only to be recommended in exceptional cases, such as hoisting by stages, lack of room for boiler house, small hoists while sinking, etc. In the case of large collieries, or when dealing with central power supply undertakings, the power required by the hoisting machine is small in comparison with the total capacity of the station, and in modern plants, even in comparison with the individual units. In the case of the Maritime Pit hoist the power is supplied by the Consumers' Company of the South Wales Power Company at a rate which works out at slightly over one cent per kilowatt-hour.

Considerable thought had to be given to the question whether the Ilgner equalizer plant or the Westinghouse system should be adopted. It was recognized that both systems have their advantages, but the main point which decided the management to adopt the Westinghouse system was that in that system a three-phase motor is used capable of being run direct from the mains. In the event of a breakdown of the equalizer set, a stoppage at the pit is thereby avoided, and hoisting can proceed at a reduced output. Further, as Mr. Hooghwinkel stated in a paper read by him before the South Wales Institute of Engineers, the absence of recuperative power with this system was met by the ingeniously designed drum, which, if properly handled, stops without any braking being required after current is cut off. The writer understands that from the time of starting up the operation of both the three-phase motor and the Westinghouse rotary converter load-equalizer, has proved thoroughly reliable and efficient.

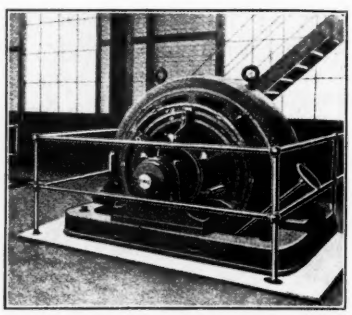


DIRECT-CURRENT FLYWHEEL MACHINE, MARITIME PIT, WALES.

The hoisting house and head gear, which are shown in the pictures, were laid out especially for electrical working. The hoisting machine consists of a spiro-cylindrical drum of from 7 feet 6 inches to 15 feet in diameter, designed for a rope 5.5 inches in circumference, and driven by the direct-connected three-phase motor, having a normal capacity of 700 horsepower at fifty-seven revolutions per minute and wound for the Power Company's supply at 2,200 volts and twenty-five cycles. The whole equipment is controlled from the switchboard gallery, where the necessary operating levers and instruments are mounted. The hoisting motor is operated by a liquid controller with an oil switch, especially designed for this class of service by the British Westinghouse Electric and Manufacturing Company. The hoist is equipped with a compressed-air brake, recording tachograph and devices for preventing overwinding and overload. The hoisting is also automatically stopped in case of failure of the electric or air supply.



GENERAL VIEW OF THE ELECTRIC HOISTING PLANT AT THE MARITIME PIT, WALES.



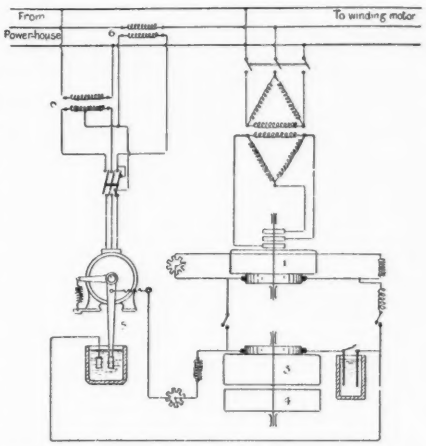
ROTARY CONVERTER AT THE MARITIME PIT, WALES.

The Westinghouse converter equalizer equipment, which is illustrated herewith, consists of a 400-kilowatt six-phase rotary converter, provided with the necessary transformer and coupled electrically at the other end to a 350-kilowatt direct-current machine having an eleven-ton fly-

wheel on the extended shaft. At times of light load the flywheel stores up energy in being driven by the direct-current machine running as a motor fed by the rotary converter. The action of the set is reversed when the load rises above a predetermined point, the flywheel then driving the direct-current machine as a generator supplying current to the rotary converter, to be delivered in turn to the line. The field of the rotary can be so adjusted that the alternating current delivered to the line will be a leading one, thus compensating for the lagging current due to the hoisting motor.

The writer is informed that the official trials on the plant showed an energy consumption of less than two kilowatt-hours per ton of coal raised from a depth of 1,110 feet when hoisting at the rate of seventy trips per hour, with an average net load of 2.35 tons. This consumption, which includes that of the auxiliaries, corresponds to a steam consumption of 28.8 pounds per shaft horsepower-hour; this figure is based on electric generation at eighteen pounds of steam per kilowatt-hour. It is stated that a steam hoist would take about thirty-five pounds of steam per shaft horsepower-hour, or in this case twenty per cent more than the electrical hoist.

In his paper, read before the South Wales Institute, to which reference has already been made, Mr. Hooghwinkel, who acted as consulting engineer for the whole of the work and who has long been known



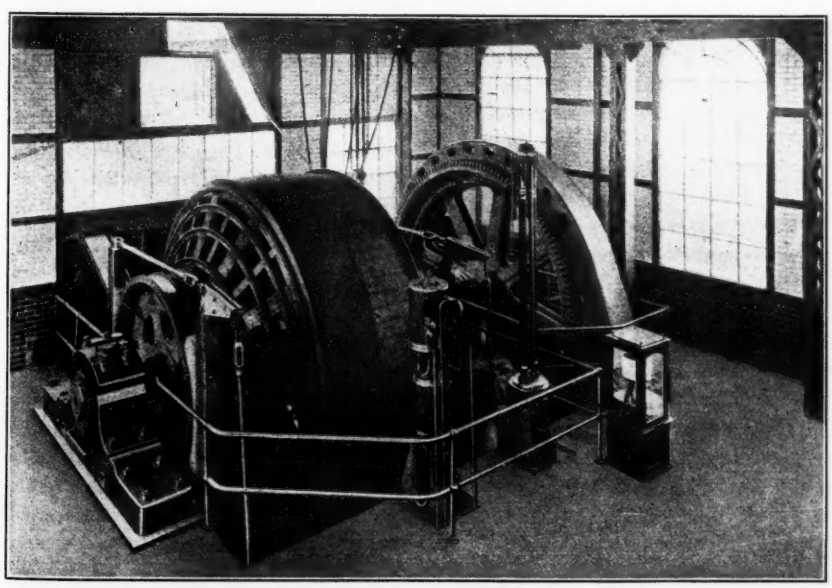
ROTARY CONVERTER EQUALIZER SYSTEM USED AT THE MARITIME PIT.

1. Rotary converter.
2. Transformers for supply rotary.
3. Flywheel machine.
4. Flywheel.
5. Automatic regulator.
6. Series and shunt transformers for controlling 5.

A liquid starter, combined with a three-pole reversing switch suitable for starting, reversing and regulating the hoisting motor, is of a special type, consisting of two large tanks, one of which contains the blades, the other one serving as a reservoir for the liquid. The two tanks are fixed one upon the other, both being connected by inlet and outlet pipes, and the water is forced by an electrically driven centrifugal pump from the lower to the higher tank, circulating continually between the two. An overflow is provided in the upper tank, which if raised causes the liquid to rise, so that by means of it its level may be adjusted. Even with the lowest level the blades are in contact with the liquid. The overflow is mechanically connected to the reversing-switch and to the main lever on the operator's platform. There is a three-phase emergency oil-switch suitable to break 400 amperes at 2,000 volts, and it is provided with electrical and mechanical overload release, with tripping for connecting to the depth indicator, the emergency brake lever and the no-voltage release magnet. The latter is a three-phase magnet connected to a transformer. This magnet is mechanically connected to the emergency switch and acts as a release in case of no-voltage, or in case the voltage drops below a certain minimum. The primary of the twelve-kilowatt, 2,200-220-volt, three-phase transformer is connected to the main high-tension circuit, the secondary supplying energy to the magnet already mentioned and to the motor driving the centrifugal pump in the liquid starter, and also the three-horsepower air-compressor motor. The brakes, which are linked to the drum, are operated by compressed air, or, in case of emergency, by a heavily weighted lever.

The whole of the control gear is operated by means of three levers which are fixed on the operator's platform. One lever serves for actuating the primary reversing switch and the liquid rheostat. The action of the liquid starter is such that the acceleration is automatic and quite independent of the speed with which the operating handle is operated. First, the primary switch is actuated; then the liquid starter. If the lever is moved to an intermediate position the primary switch is being operated, while the liquid starter only moves into a position corresponding to that of the handle. In this way the speed of the hoist can be varied within any limits up to full speed. The design of the control gear is such that counter current can be given to the motor when lowering, if necessary. The second lever on the left-hand side of the operator controls the power brake. The third, which is in a central position, is only operated in case of emergency, and operates the release of the weighted end of the brake lever through a tripping device and also brings the emergency switch to the "off" position by means of rods and links, thus interrupting the circuit of the motor.

The control gear for the load-equalizing set and flywheel machine field-regulator automatically regulates the voltage of the machine by varying the resistance in the field circuit. The voltage is controlled by a quick-acting regulating apparatus from



ELECTRIC MOTOR-DRIVEN HOISTING MACHINE AT THE MARITIME PIT, WALES.

in England as an electric mining expert, gave fuller details regarding the controlling gear, from which we may quote:

the high-tension transmission line through series transformers. The operation is automatic so that the converter equalizer discharges its energy into the high-tension system whenever the load of the same is higher than the constant station output, and it stores energy in the flywheel when the power demand in the high-tension supply system is less than the constant output of the station. At no-load the rotary converter is acting at 100 per cent power-factor, giving the total constant capacity into the flywheel until it has come to its maximum speed. The capacity of the flywheel is designed large enough in order to take care of the overload and underload periods of the hoisting motor.

In a paper read before the Manchester Local Section of the Institution of Electrical Engineers on the subject of "Flywheel Load Equalizers," J. S. Peck made considerable reference to the Maritime Pit plant, and in one of the diagrams herewith reproduced showed the arrangement of the British Westinghouse system.

Accumulator Motor Cars.

Electrically operated rail motor cars in which the energy is supplied by means of accumulators have for a number of years been in use on the Palatinate railways, and Herr A. Giesler, the chief engineer, has compiled an exhaustive report dealing with the performance of these vehicles, of which a translation recently appeared in the Bulletin of the International Railway Congress. As early as 1900 seven accumulator cars were in service, four on the standard-gauge and three working on narrow-gauge lines. The latter have since been withdrawn, owing to tramway extension in the districts concerned. The cars now used are operated over seven routes, with an average length of twenty-seven kilometres, among which is the round trip between Ludwigshafen and Worms, a distance of 43.4 kilometres, and the journey from Neustadt to Schifferstadt, 17.2 kilometres. The average consumption of current is about twenty watt-hours per ton-kilometre. Over a period of seven years the eight-wheeled cars spent on the average rather less than twelve per cent of their total working time in the repair shops. This figure shows a certain advantage over the steam locomotive, the average period during which locomotives were under repair in the whole of the German Empire amounting to 18.01 per cent during 1905. The entire working cost amounts to about nine cents per kilometre, or, say, fourteen cents per car-mile.

Electrical Notes from Italy.

(By Our Italian Correspondent.)

From the report on the operation of state railways it appears that for the development of electric traction during the current fiscal year expenditures of 1,166,020 lire have been authorized for work, 3,360,133 lire for the supply of machines, tools and equipment, and 2,050,000 lire for locomotives.

On June 30, 1908, work on the section between Genoa (Campobasso) and Bussalla had already advanced to such a point that it was expected to put the boilers and turbo-alternators in the power station at Genoa in operation very soon. A large part of the poles for the power line and also for the overhead contact wire have been erected and the work of equipping the stations has begun. The erection of the buildings for the four transformer substations is nearly finished and the furnishing of the locomotives has begun. Before being put in operation on this line the locomotives will be tested for some time on the Valtellina road.

On the Lecco-Calolzio section the poles have been already installed for testing a type of line equipment proposed by the Westinghouse and Ganz companies.

Negotiations for the supply of the different parts of the equipment of the Savona-San Giuseppe line have been concluded, and plans for the erection of the central station at Vado Ligure are under investigation.

Initial steps have been taken with a view of extending the Morbegno water-power plant. It is intended to increase this station so that all the power which it is possible to derive from the Adda may be utilized. By this extension and by making use also of the power that is to be put at the disposal of the state railways near Usmate by the company owning the waterpower concession of the Adda between Bivio and Paderno, electric traction will be extended as far as Milan and Bergamo.

For the purpose of introducing electric traction on the Bardonecchia-Modane division, negotiations have been continued with the Paris-Lyon-Mediterranean Railway regarding the cost of the section extending from the French frontier to the interior of the Frejus Tunnel and the Modane Station.

The transformation of the Naples-Salerno division and of the Torre Anunziata-Castellamare branches will be accomplished by utilizing the power reserved in the concession of the Tusciano River and that which will be generated in a steam-power station near Torre Anunziata. Since the power of the Tusciano was reserved in common with the municipality of Naples an arrangement has been made with the latter by which all the power of the Tusciano will be ceded for the railway, while the city of Naples will receive in exchange the concession for the power obtainable from the Volturno between Rio de la Rocchetta and the Vandra, which was previously owned by the railway.

Plans for the introduction of electric traction on the Domodosella-Iselle section on the Milan-Callarate-Arona and on the Callarate-Laveno lines are presently under investigation.

The project for an electric railway between Tirano and Bormio is being examined at the Ministry of Public Works. The distance is 39.4 kilometres, and the line rises from 430 metres at Tirano to 860 metres at Balladore, reaching 1,225 metres at Bormio; the average grade is 20.17 per cent and the maximum grade 26.95 per cent. These places are very important summer resorts, and at the present time there is an automobile service between them during the warm months, and horse-drawn vehicles effect the transportation during the other months of the year. The total cost of the line would be 8,000,000 lire.

The Italian Hydro-Electric Company (a Milan corporation with a capital of 10,000,000 lire) has been granted the right to utilize for motive power and the production of electrical energy for distribution in the province and outside for all industrial uses (light, traction, etc.) the waters of the Masino River and its tributaries, called Valle dei Bagni, Valle di Mello, Valle Spluga, Valle Sasso Bizolo, as well as of the Predarossa and Serzana rivers and their tributaries, to construct a storage reservoir capable of containing 115,000,000 cubic metres of water and to carry out all the work and construction in connection with this project and its exploitation.

ENRICO BIGNANI.

Milan, May 1.

Florida Electrical Association.

At a meeting held April 21-22 by Florida electric-light men at Orlando, a state electrical association was formed and the following officers elected: President, H. A. Grant, Orlando; vice-president, W. H. Bostwick, Jacksonville; secretary and treasurer, G. F. Doig, Gainesville. Directors—F. E. Fletcher, Tampa, and C. H. Ellis, Tallahassee.

The American Electrochemical Society.

The Fifteenth General Meeting, Niagara Falls, Canada, May 6, 7 and 8.

The fifteenth general meeting of the American Electrochemical Society was held at the Hotel Clifton, Niagara Falls, Canada, May 6, 7 and 8. From every point of view this was the most successful gathering which the society has ever held. There was a fine list of papers and although the discussion was meager the subjects appeared to be so well in hand that everyone was entirely satisfied.

The entertainment features were of a high order and participated in with spirit. The visiting ladies were entertained by Mrs. E. G. Acheson and the ladies of the local committee. During the convention the members and guests visited the power houses of the Ontario Power Company, the Electrical Development Company, the Canadian Niagara Power Company, the International Acheson Graphite Company, the Niagara Hydraulic Power and Manufacturing Company, the Niagara Falls Power Company and the Development and Funding Company, where the Townsend electrolytic cell was shown in operation.

The banquet on Friday evening, followed by dancing, was a fine affair, and the responses to the toasts were received with great satisfaction. Considerable enthusiasm was aroused at the banquet by the address of Cavalier Ernesto Stassano. President-elect Baekeland, in a brief address, thanked the society for the honor it was conferring upon him in electing him president, assured the members that he appreciated the responsibility, and asked for the same co-operation during his administration which had been accorded to Mr. Acheson. He called attention to the excellent work done under the administration of Mr. Acheson, and a standing toast and cheers were given to the retiring president.

There were a few exhibits in the meeting room, included among which was the new furnace pyrometer described in one of the papers, the autographic register and the ammeter for the measurement of large currents manufactured by Leeds & Northrup Company. Exhibits were also made by the Norton Company, the Carborundum Company, the Electro-Metallurgical Products Company, John A. Yunck, Maximilian Toch, the Dossert Electrical Company and the Boonton Rubber Company exhibiting a number of electrical and electrochemical applications made from Bakelite.

THURSDAY MORNING SESSION.

The formal proceedings were opened by the president, E. G. Acheson, who introduced Dr. Eugene Haanel, chief engineer of the department of mines of the Dominion of Canada, and who has been at the head of the Canadian commission which has been making a study of the electric furnace for the smelting of Canadian iron ores. Dr. Haanel described a new type of arc furnace which had been developed by a syndicate of Norwegian engineers. Tests made on this furnace showed that it operated with great uniformity, the electrodes required no regulation, the feeding being perfectly automatic at one run for a period of five days. The consumption of energy was remarkably small for the output, and it would seem to be an ideal load for a central station. The free space between the walls and the charge was maintained throughout the runs, and the charge did not jam in the contracted neck of the furnace, but flowed uniformly into the melting chamber.

"Electric-Furnace Pig Iron in California" was the title of a paper presented by P. McC. Bennie. This described the Herault furnace erected by the Noble Electric Steel Company, at Herault, Shasta County, California. The price of pig iron on the Pacific Coast is between $23 and $25, and the location is not favorable to blast-furnace work. Power for the furnace is furnished by the Northern California Power Company. The present furnace is of 1,500 kilowatts capacity, and the consumption works out to about 2.5 horsepower-years per ton of pig iron. The pig is reduced from a fairly good magnesite ore. The furnace requires about one ton of charcoal per ton of pig iron. Pig can be produced for about $15 per ton, and allowing $3 per ton for freight to San Francisco, the price leaves a fair margin for profit.

The experiments were begun at Herault by Mr. Noble, president of the Northern California Power Company, in 1906. In July, 1907, a 1,500-kilowatt furnace of the three-phase, resistance type. Considerable change was then made, and a 160-kilowatt furnace constructed. The present 1,500-kilowatt furnace is of the three-phase type with six electrodes. The company has recently completed a charcoal plant at an expenditure of $50,000.

Prof. Joseph W. Richards read a paper entitled "The Electric-Furnace Reduction of Iron Ore." Professor Richards emphasized the conflicting characteristics of blast-furnace working and electric-furnace working. The amount of fuel used in a blast furnace is determined by the amount which must be burned at the tuyeres to produce the necessary smelting temperature, and not by the amount necessary to perform the reduction of the metallic oxides. The amount necessary for performing the reductions taking place in the furnace is only one-third to one-half of the amount necessary to be burned to provide the smelting heat. That this statement is true of the ordinary blast furnace may be seen from the fact that if the smelting zone is increased in temperature by heating the blast, the amount of carbon used in the furnace per unit of pig iron made is at once reduced. Or if the heat available in the smelting zone is increased by drying the blast, economy of fuel at once results. In fact, any means of getting high smelting temperature without combustion of carbon before the tuyeres, decreases at once the quantity of fuel necessary to use in the furnace, since the quantity used is determined by the heat requirements in the smelting zone, and not by the requirements for reduction, which are only a fraction of the former.

In the electric furnace all the necessary heat is supplied by the electrical energy, no air is blown in and all the solid carbon used for reduction (always except the small amount which dissolves in the pig iron). One-third as much carbon is the greatest amount, and between one-third and one-fifth is the smallest amount necessary, compared with the blast furnace.

Professor Richards suggests a combined blast and electrical furnace, providing tuyeres by which air can be sent into the crucible of the furnace, burning any accumulation of carbon. Whenever the falling resistance of the furnace indicates that carbon is beginning to accumulate an increase of air is supplied, diminishing as the accumulation of carbon is diminished.

During the discussion of these papers the question of the suitability of electric pig iron for steel was brought up. The content of nitrogen is less in Bessemer steel than in the blast-furnace product,

and less in crucible steel than in Bessemer. Tests should be made to determine the character of the electric-furnace product.

A paper by Cav. Ernesto Stassano, of Turin, Italy, describing the Stassano furnace, was presented. Mr. Stassano was present, but his paper was translated and abstracted by Professor Richards. This paper reviewed the historical development of the electric furnaces of the resistance, arc and induction types. The electric furnace does not bring into the reduction and refining of iron any new element except a better commercial utilization of heat. The advantages of the Stassano furnace are its horizontal electrodes; the elimination of air circulating through the melting chamber; the hermetically closed chamber makes a higher temperature possible; eliminates the introduction of foreign substances, and allows working with a full charge.

A paper by Ch. A. Keller, of the Societie des Establissements Keller-Leloux, Levet, Isere, France, was read in abstract by P. McC. Bennie. This paper emphasized the importance of the use of a non-carbonizing furnace bottom.

A paper by Paul Girod, of the S. A. Electrometallurgique Procedes Girod, Ugine, Savoy, France, describing the Girod furnace, was abstracted by L. E. Saunders.

A paper by Robert Turnbull, resident American engineer for Dr. O. L. I. Herault, entitled the "Herault Electric Steel Furnace," was read by F. A. J. FitzGerald.

The first furnaces of this type were built in 1887, of the crucible type, the bottom of the furnace forming one pole and the electrode dipping into the charge the other. In 1890 a furnace of this type was erected at Boonton, N. J., for the production of various alloys, operating until 1899, when the production of low carbon ferro-chrome was begun. This was subsequently abandoned and experiments proceeded for the production of steel. The advantages of this type of furnace are the absence of electrical parts in the furnace; the low current cuts down the section of the conductors; the heat is generated in the slag; the use of proper kind of scrap is permissible, and special slags may be employed. This type of furnace has been adopted by the United States Steel Corporation, two three-phase furnaces of fifteen tons capacity having been erected, one for the South Chicago works of the Illinois Steel Company, and one for the Worcester works of the American Steel and Wire Company. The electrodes are two feet by ten feet, the current density is twenty-eight amperes per square inch, and it is expected that they will run about sixteen heats per day.

W. N. Matthews said there was no question about the practicability of making steel in the electric furnace, but some careful investigations should be made of the character of the product. There should especially be an authoritative investigation of the gaseous impurities of steel.

Professor Richards read a communication from Paul Girod concerning the quality of steel made in the electric furnace, which Mr. Girod thinks is not up to the quality of crucible steel. He does not think that steel taken from Thomas or Martin furnaces and then processed in the electric furnace are as good as when the charge is started cold. The higher temperature of the electric furnace also makes the elimination of impurities more difficult. He would never recommend making tool steel by taking the metal from a Siemens or Thomas converter.

THURSDAY AFTERNOON SESSION.

The Thursday afternoon session was opened with an address by Louis Simpson, of Ottawa, Canada. Mr. Simpson gave a very interesting account of the conditions which led up to the appointment of the Royal Commission by the Dominion of Canada for the experimental research on electric-furnace work in connection with Canadian low-grade ores. The electric furnace was doing excellent work in Sheffield, England. While it is not generally announced, it is known to be a fact that a number of steel makers there are using electric furnaces. The electric furnace will also be started up on a large scale in Norway and in India, and before the end of the year it is expected that a syndicate will contract for a number of electric furnace propositions in Canada.

"Self-Circulating Gin Furnace for the Electric Manufacture of Steel," by Gustave Gin, was translated and read by Professor Richards.

In induction furnaces with an uncovered canal it is difficult to get a uniform distribution of the heat and of the refining reactions because of the small heat conductibility and slight diffusability of the melted material. Improved results are secured by obtaining a continual circulation of the melted matter. This object is attained by Schneider in the furnace described in his United States Patent 761,920 and by Gin in his United States Patent 875,801. These furnaces contain receptacles for the metal alternately in sumps and narrow passages connecting these completely filled with metal. The canals are inclined and the ascensional movement in the inclined connecting passages produces a continuous circulation in the entire liquid charge. It may be expedient to combine electrode and induction heating when making steel from materials carrying much impurities. In such a case the large amount of slag covering the bath offers a large electric resistance. If the heating is by induction only the temperature is developed almost entirely in the metal and the slag is insufficiently heated for keeping it properly fluid and active.

A paper was presented by Dr. Carl Hering on a mathematical analysis of the Gin induction furnace.

A description of the Kjellin, Rochling-Rodenhauser electric furnaces, by Dr. F. A. Kjellin, was read by John A. Hay.

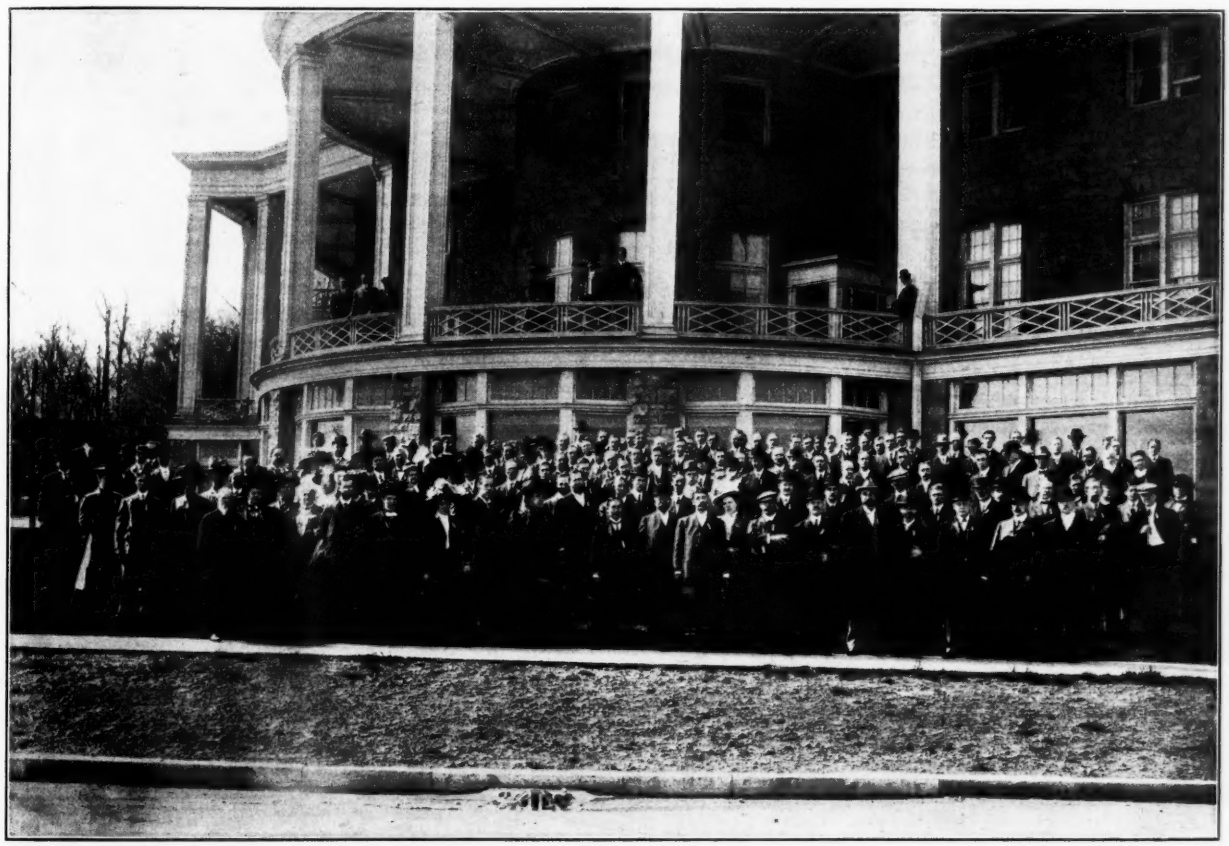
The Kjellin furnace is in reality a transformer in which the bath of molten metal forms a secondary circuit. The magnetic circuit is built up of laminated sheet iron, the primary coil, consisting of a number of turns of insulated copper wire or tubing surrounding the magnetic circuit. The ring-shaped crucible, made of suitable refractory material, surrounds the magnetic circuit, and when filled with molten metal forms the secondary circuit of the transformer. In a small furnace of this type an alternating current of 500 volts and 280 amperes induces a current of seven volts and 20,000 amperes in the metallic bath. The method of working the induction furnace is peculiar to itself because it is not possible to fill the crucible with broken pieces of pig iron or scrap and melt these down, the voltage of the induced current being too low. Instead, an iron ring must be placed in the crucible, melted down and form a bath, or the crucible must be filled with molten metal taken from another source. In continuous working the custom is to leave a sufficient amount of metal in the crucible to establish the bath. The steel delivered from this furnace possesses many interesting and valuable qualities, standing particularly heavy tensile and torsion tests. It also appears that steel can be made in the induction furnace with less additions of silicon and manganese than is necessary in the crucible.

The necessary theoretical power per ton of steel produced from cold pig iron and scrap is about 489 kilowatt-hours. The

experimental furnace at Gysinge, Sweden, consumed about 800 kilowatt-hours per ton when working with cold pig iron and scrap. When working with cold pig and iron ore briquettes the power consumption per ton of steel was increased about fifty per cent.

In the Rochling-Rodenhauser electric furnace the iron core of the transformer has two legs, both surrounded by primary coils. These coils are connected with the alternating-current generator. Secondary currents are induced in two closed circuits formed by the bath. These two circuits are connected so that the whole looks like a figure 8. The furnace acts like two combined ordinary induction furnaces. There are, however, secondary coils surrounding the primary coils. From these secondary coils currents are conducted to metallic plates. These plates are covered by electrically conducting mixtures of refractory material, which form part of the lining of the furnace. The effect of these secondary coils is a considerable increase in the power-factor. Another advantage is that the magnetic leakage field surrounding the primary coils, which in the simpler type of furnace had the effect of checking the primary current, is now utilized for inducing currents in the extra secondaries. The main hearth can be made with a larger cross-section and a good power-factor obtained even in big furnaces without the use of a low periodicity. For some time past steel made in a Rochling-Rodenhauser furnace has been manufactured into rails of standard section for use on the United Prussian State Railway.

A mathematical paper was presented by Dr. Carl Hering, entitled "Working Limit in Electrical Furnaces Due to the Pinch Phenomenon."



THE CONVENTION OF THE AMERICAN ELECTROCHEMICAL SOCIETY, CLIFTON HOTEL, NIAGARA FALLS, CANADA, MAY 6-7-8.

When an electric current passes through a liquid conductor the conductor tends to contract in cross-section, due to electromagnetic forces. This contracting force is small for relatively low-current densities, but is quite large when they become greater, large enough to rupture the circuit. This contraction is apt to form locally at some particular spot. It forms a depression in a channel of molten material, having the appearance of pinching the liquid by an invisible force. If the solid infusible materials fall into this depression a pinching off and freezing of the charge may result before the obstacles can be removed. The phenomenon is not of a simple nature, and a purely mathematical solution cannot be depended upon absolutely for calculating actual cases. From experiments made with an apparatus for producing as nearly as possible the conditions in an electrical furnace, it appears that a formula can be developed enabling one to calculate the critical current density directly from the density of the material and the original depth of the liquid conductor. The critical current fixes a very positive limit, which the current, and therefore the temperature, cannot exceed. In these furnaces the danger is greater in small and shallow than in large and deep channels.

The paper entitled "Application of the Lash Process to the Electric Furnace" was read by Francis A. J. Fitzgerald.

The Lash process might be described as a compromise between certain methods of refining and the direct production of steel from the ore. Horace W. Lash discovered that when an intimate mixture of iron ore, carbon, fluxes and cast-iron borings was heated that reduction rapidly took place, and that by a suitable proportioning of the mixture the desired grade of steel could be obtained. Steel may be produced in an electric furnace, using the

Lash process, with an expenditure of approximately 1.63 kilowatt-hours per kilogram, or 0.25 horsepower-year per metric ton. There has been no difficulty in obtaining granulated pig iron for the mixture, manufacturers being ready to supply it at the same price as pig iron in the ordinary form.

Richard Moldenke, secretary of the American Foundrymen's Association, said that it was quite possible that the Lash process in connection with the electric furnace would afford manufacturers of small steel castings an opportunity of making these upon a very economical basis. He had conceived the idea of using ingot steel, heating this almost to the melting point by the regenerative process, and then finishing in the electric furnace.

F. M. Lane said that the process of making steel castings for small manufactures would be valuable and the expense would not be considered if the process would use borings and steel turnings. He hoped that the electric furnace would be a solution of the problem of utilizing this otherwise waste material.

Contributions from Mr. Gin on the advantage of the electric furnace for manufacturing silico vanadium and on the properties of ferro vanadium were read by F. A. Lidbury.

A descriptive paper by Remo Catani of the Société Elba, Elba, Italy, on the advantage of the electric furnace in the iron and steel industries was read. This was followed by a paper entitled "Present Value of Electrical Structural Steel," by Henry D. Hibbard.

Mr. Hibbard emphasized the point that there should be no sentimental regard attached to the use of the electric furnace for producing steel. The matter should stand entirely on its merits, and unless there appeared to be some definite economic and commercial advantage in using the electric furnace the time was not at hand for its positive development. It appeared to him that the beneficial result of the advantages offered with electric steel melting lies more in the direction of improved qualities in the product than in lessening its cost.

Professor Richards replied to Mr. Hibbard's paper with the suggestion that electric steel was being made in direct competition with other processes, and repeated that there were some eighty electric furnaces now in operation.

Anthony Victorin contributed a discussion on this subject, using as a basis for his analysis a plant at Philadelphia with a capacity of 12,000 tons per year of salable castings. With coal at $3.50 a ton and with high costs for oil and gas, it appeared that the margin of profit when the electric furnace was used was greater than with any other process.

A paper entitled "A New Radiation Pyrometer" was read by Charles E. Foster. Mr. Foster described a pyrometer of the Fery type, which instead of using a thermo-junction at the focus of a concave mirror, focused the radiant heat upon a bimetallic coil spring member. One end of this spring was fastened to a thermo-junction and the other end was fastened to a light pointer traversing a scale. The action of the thermo-junction caused the coil to unwind, causing a corresponding deflection of the pointer. The instrument offered a great many advantages, the chief

A CONVENTION GROUP.

Dr. L. H. Baekeland, President, in center; at his left, Cav. Ernesto Stassano; at his right, Dr. B. Katsura.

of which was that it could be focused upon the material, the temperature of which was to be measured, and no part of the apparatus entered into the furnace, in this way eliminating deterioration. The apparatus is provided with adjusting devices, and as long as the focus was maintained correctly the distance of the apparatus from the hot body was immaterial. It takes about twenty seconds for the pointer to reach a steady deflection and the range of the instrument is indeterminate toward the upper limit. The accuracy was about two per cent between 500 degrees and 1,000 degrees centigrade, and the apparatus holds up its calibration very well.

The paper entitled "Furnace Electrode Losses," by C. A. Hansen, closed the afternoon session. Mr. Hansen gave a great deal of very interesting information concerning the losses which take place in furnace electrodes by heating conduction to the atmosphere outside of the furnace, and showed that in some cases this was greater than C^2R loss. In the experiments made by Mr. Hansen it was shown that in furnaces taking 500 kilowatts the electrode losses can easily reach fifteen per cent.

THURSDAY EVENING SESSION—THE PRESIDENTIAL ADDRESS.

The address of the retiring president, E. G. Acheson, was delivered on Thursday evening, a full attendance of members and guests being present. One of the delightful features of this session was the presence of the ladies of the convention.

Mr. Acheson took for his topic "The Electrochemist and the Conservation of Our Natural Resources."

The opening thought of Dr. Acheson's address carried him back in memory to the Joint Conservation Conference held in Washington, D. C., in December of last year. He told how he felt a thrill of pride in being one of the people of the United States when President Roosevelt stated this nation was first to take steps to conserve natural resources. It was with profound pleasure that he realized that the people of the United States are now great enough to call a halt in the heedless consumption of the world's stock of necessities; rich enough to construct great works for the attainment of that end; scientific enough to create artificial duplications of the natural and add to the list of the materials nature has provided for man's use, and, lastly, humane enough to devote some thought, work and resources toward providing for posterity.

Dr. Acheson reviewed briefly the work of the conference, pointing out the disposition to create expensive waterways, but the failure of the body to take steps looking to the actual conservation of our perishing resources, caused regret and surprise. It was his expressed belief that to utilize fully the natural inexhaustible resources, while conserving the natural exhaustible resources, would be an example for the entire civilized world to follow, and a step well calculated to sustain the progressive spirit of Americans. He felt it was possible for Americans to build as no other people have built, and he pointed out how this might be done through the aid of electrochemistry. It was evident from his earnest words that the retiring president of the American Electrochemical Society had most carefully studied the "great open door" before that organization, and in more than one way he told

how wonderful things might be accomplished.

An apt illustration was made in connection with the sodium-nitrate field. The center of this new industry is now in Norway, but the speaker's words intimated that he wondered how long Americans would submit to this condition. Figures most astonishing were supplied when he told, that, at the present rate of importation, the next twenty years would call for the sending of no less than $473,650,495 out of the country, a sum, he coolly stated, quite enough to dig the Panama Canal and leave a good balance to the country's credit.

In most interesting statements Dr. Acheson outlined what he felt was the logical course to pursue in the conservation of natural resources. His plan involved forest creation and protection, the impounding of waters, the construction of power plants, and lastly the development of waterways, ushering in the Electrochemical Age, with which he associated a new synthetic chemistry providing wonderful possibilities. In fascinating words he told how elements as joined by Nature are torn asunder and rearranged by man. His illustrations were extremely interesting, but none the less so was his statement that electrochemists are even now earnestly at work on problems of greater magnitude, citing the electrometallurgy of iron and steel, thus bringing his audience to the consideration of the new interests that added so much to the first day's session of the convention.

Leaving the question of conservation, he turned again to electrochemistry, saying the field is much too extensive and rich to be monopolized by any one or two of the professions. He portrayed a brilliant future, and in conclusion approached prediction when he said: "The government will, I think, ere long recognize the electrochemists, and our society in particular, as an important factor in the industrial and commercial life of the nation, and as a means of materially conserving the interests of posterity. It may be that it will in time see the advisability of establishing a department devoted to these interests."

THE SMOKER.

After President Acheson's address the ladies retired and a smoker was held under the auspices of Section "Q." This was one of the most successful entertainment features which has ever been held in connection with any of these conventions. The local talent, headed by the irrepressible Lidbury, entertained everyone into the small hours of the morning, and there were many clever and decidedly interesting humorous papers on near-electrochemical and scientific subjects. Those participating in the fun included P. McN. Bennie, A. H. Hooker, F. A. J. FitzGerald, H. R. Cravath, Wilder D. Bancroft, L. E. Saunders and F. A. Lidbury. A number of good turns were given by professionals from Toronto, and during the evening the members and guests joined in the jollification by singing the choruses from all the popular songs. One very impressive exemplification of the remarkable spirit of international comity which existed was the singing of "America," followed by the singing of a verse of "God Save the King," all present, including those of every nationality, joining lustily.

FRIDAY MORNING SESSION—NEW OFFICERS.

The Friday morning session was opened by the reading of the report of the Board of Directors. This showed that the increase in the membership amounted to thirteen per cent, as against ten per cent for 1907. It was also stated that the first three months of 1909 showed as many new members as the whole of the year 1908. There were enrolled at present 900 members, fifty new members had just been elected, and there were ninety candidates whose applications had not been passed upon.

The report of the tellers showed the following officers elected for the ensuing year:

President, L. H. Baekeland.

Vice-Presidents, F. J. Tone, Carl Hering and W. D. Bancroft.

Managers, E. R. Taylor, W. L. Miller and W. H. Walker.

Treasurer, P. G. Salom.

Secretary, J. W. Richards.

The discussion on the paper presented by Mr. Hansen, entitled "Furnace Electrode Losses," was then taken up. Mr. Lidbury suggested that the conditions found in the tests might be reversed if electrodes without water cooling were used.

Mr. Hering suggested that an attempt be made to let the two losses help each other to strike a balance. If it were possible to make the hot end a little hotter than the furnace, the heat gradient would tend to keep the conduction currents flowing into the furnace.

The paper entitled "A New Type of Ammeter for the Accurate Measurement of Alternating Currents Above 1,000 Amperes" was presented by Edwin F. Northrup.

The method used in this apparatus is based upon the utilization of the recently observed centripetal pressure which exists in the interior of a liquid conductor carrying an electric current. When an electric current of large density is passed through a fine jet or stream of mercury or molten metal the stream suffers at some point of its length a constriction. The apparatus depends upon the difference in pressure between the inner and outer circumferences of a circular cell in which a jet of mercury is flowing.

The paper entitled "The Electrolytic Deposition of Lead and Zinc as Effected by the Addition of Certain Organic Compounds," by S. A. Tucker and E. G. Thomssen, was read.

Both lead and zinc present certain difficulties when deposited electrolytically from aqueous solution, and with the former it is practically impossible to deposit the metal in reguline condition from solutions of nitrate or acetate. The influence of organic matter has been studied and is known to affect the deposit favorably, as in the case of lead when gelatine is used. Experiments were also made with a rotating cathode, and it was found that in some cases the current density could be increased ninety times over that with a stationary electrode; with both lead and zinc the deposits were greatly improved.

In discussing this paper, Carl Hering said that he had found that particles of non-conductors traveling with the current are deposited on the cathode going on with the metal.

Hugh Rodman said that lead deposited in this way was not suitable for storage batteries, as it appeared to disintegrate very rapidly.

The paper entitled "Cooling Curves and a New Type of Apparatus for Their Autographic Registration" was read by Dr. Northrup. In this type of balance the recorder or galvanometer is left absolutely free to deflect a short distance to the right or left, and without its doing any work in making a contact determine the movement of the recording pen. The pointer of the recorder acts, not as a contact device, but as a selector, which determines when contact is made by means of an independent galvanometer, whether energy shall flow in one circuit or another. If energy flows in one circuit the pen moves a small but definite space interval to the left; if energy flows in the other circuit, the pen moves a definite space interval to the right. If the pointer does not deflect at all, no contact can be made by the independent contact-

ing device, energy will not flow in either circuit, hence the pen will not move.

The paper entitled "Electrodeposition of Some Metals from Acetone Solution," by Harrison E. Patten and William Roy Mott, was read by Mr. Mott.

The work may be summarized as follows:

(1) Sodium and strontium metals have been deposited from saturated solutions of the iodides in acetone at room temperature, using rather high current density.

(2) Cadmium, tin, antimony, bismuth and arsenic have been deposited from solutions of their chlorides in acetone at moderately low-current density.

(3) Iron and copper were deposited from solutions of their chlorides in acetone at rather high current densities.

In answer to a question, Mr. Mott said it appeared to be impossible to deposit aluminum from either acetone or alcohol solution.

William Koehler stated that he had succeeded in depositing aluminum from dilute aluminum chloride, using an iron cathode. He said his experiments had led him to conclude that aluminum can be deposited from an aqueous solution, but that the process is not at present a commercial proposition.

The paper entitled "Deposition of Aluminum from Aqueous Solution, Using Rotating Cathodes," by S. A. Tucker and E. G. Thomssen, was presented.

It seemed possible to the experimenters that if the speed of rotation could be sufficiently increased that the current density might be raised to such a high value that metals could be deposited from aqueous solution, which under ordinary circumstances would not deposit at all. The first experiments were carried on with a cathode revolving at 3,200 revolutions per minute. The electrolyte was an aqueous solution of aluminum chloride or sulphate with an anode of sheet aluminum. The cathode consisted of a brass or copper rod five millimetres in diameter. No sure indication of metallic deposit was obtained, but several times a black substance was found on the cathode on quickly removing it from the bath. The rotation was increased to 3,500 revolutions per minute, but nothing that could be called a coherent metal deposit could be obtained. By using a very concentrated or pasty solution and rotating the cathode as fast as possible with the means at hand the blackening was much more marked and was found to be invariably on the side of the cathode having the greatest peripheral speed, due to the slightly eccentric motion of the revolving rod. When the rotation was increased to 10,000 revolutions per minute there was a trace of metallic aluminum.

Mr. Tucker said that he did not think the results were worth anything. He suggested, however, the use of this practice for the depositing of other metals, as it appeared that there was really a gain made when using similar methods.

During the discussion it was stated that calcium does not come down in reguline condition, and the same thing happens with strontium. With the calcium it appears that there is a mixture of calcium oxide and calcium.

Dr. O. P. Watts said that it seemed to him much more probable that the deposit was calcium sub-chloride rather than metallic calcium, as the gray, spongy mass has very much the appearance of the metallic calcium, and leads one into error.

The paper entitled "Electrolytic Deposit of Platinum," by W. J. McCaughey, was read by title.

The paper entitled "The Electrolytic Production of White Lead," by John C. Hunck, was read by title.

In discussing this paper, Dr. C. F. Burgess said that, in his opinion, there would be an accumulation of hydroxyl atoms in the electrolyte; there would be a liberation of ammonia; plumbate would be formed; there would be a redissolving of the precipitate, contaminating the product, and that a desirable quality of white lead would not be procured.

Two papers were then presented by G. A. Hulett, entitled, respectively, "The Electromotive Force of Cadmium Amalgams" and "The Thermodynamics of the Weston Standard Cell."

In the former paper Mr. Hulett discussed the preparation of cadmium amalgams, and showed the relation between the cadmium amalgams of known concentration, and the mathematical function which could be used in calculating the varying points.

In calculating the thermodynamics of the Weston standard cell, Mr. Hulett said the problem to be solved was whether Helmholtz's equation, $Q = E - T \times \frac{dE}{dT}$ took into consideration the change of composition of the cadmium amalgam.

In the discussion on these two papers Mr. Hering raised the question whether it would not be more practicable to calculate the heat of combination by electrical methods rather than directly.

Mr. Hulett replied that the real difficulty was with the temperature coefficient. This is the difference of two temperatures containing the errors of both, and this is multiplied by the absolute temperature.

The paper entitled "The Electrolytic Reduction of Nitric Acid," by Harrison E. Patten and W. J. McCaughey, was abstracted briefly by Mr. Mott.

A paper entitled "The Electromagnetic Separation of Non-Magnetic Non-Conducting Substances," by A. P. Steckel, was abstracted by Dr. Hering. This paper described an interesting phenomenon which results when a fluid conductor is surrounded by a strong magnetic field. The apparatus and experiments were the result of a study of the problem of obtaining a more thorough concentration of Lake Superior native copper ores. The experiments were carried out at the Buffalo Smelting Works, and it was found that when the conducting fluid was in the strong magnetic field the apparent specific gravity would be changed, so that metals would float or wood would sink, according to the direction of the current. The process was not successful for the purpose for which it was devised, owing to the extreme agitation of the conducting fluid.

THE SATURDAY MORNING SESSION.

The paper entitled "The Probable Electrical Nature of Chemical Energy," by A. H. Patterson, was presented. This paper reviewed the electrical theory of chemical combination, the source of chemical energy, the residual attraction, and the theory of electrical conduction.

Dr. Gustavus Hinrichs made a brief address, in which he called attention to the fundamental work which had been done by the older investigators. He said that in developing new theories it was impossible to get away from the fundamental work which these pioneers had done.

The paper entitled "Magnetic Tests of Some Iron Alloys," by C. F. Burgess, was read. This paper described a series of experiments on alloys of electrolytic iron with arsenic and bismuth. It is difficult to establish the accuracy of tests of this character owing to the special form of apparatus used and the variation of test samples. The observations are valuable principally because of the indication that the addition of non-magnetic materials in forming the alloy apparently increases the magnetization and also affects other electrical characteristics. The observations showed the somewhat paradoxical condition that the addition of two per cent of bismuth, the most diamag-

netic element known, improved the already high quality of the pure iron. The density values reached with this material exceeded those obtained with any of several hundred different alloys which had been tested up to the present writing. Analyses, however, have not been made of the actual bismuth content present in the alloys, so that it cannot be asserted whether the intended content and the actual content of bismuth are the same.

Of great interest was the paper entitled "Bakelite and Its Electrical and Electrochemical Applications," by L. H. Baekeland. Bakelite may be designated as the polymerized compound anhydride of a phenol-alcohol and methylenglycol. This compound is produced through indirect synthesis by the action of oxybenzyl alcohol on formaldehyde, as well as by direct action of phenols on formaldehyde. The process has been carried out in three phases, designated as A, B and C, respectively, the "initial condensation product," the "intermediate condensation product" and the "final condensation product."

The initial condensation product is used practically as raw material to start with. This is used in four varieties, each of which may be preferable according to the special purpose in view. The material A, upon being subjected to further heating, is transformed into material B, and this material upon further heating under pressure is transformed into material C. The process of heating under pressure is carried out in a special apparatus designated as a Baekelizer. This consists essentially of an inner chamber, where the objects formed of material A and B are placed, and in which by means of a suitable pump air can be compressed to 100 or 120 pounds. This pressure is maintained during the heating. A steam jacket heats the chamber to a temperature of 140 to 180 degrees centigrade.

Bakelite has a high dielectric resistance, is extremely hard and resistant to fracture, resists the action of boiling acid, and apparently has no change in structure over long periods of time. In the liquid A form it can be used to impregnate insulation on coils, its extremely high penetrating power making it possible to have the fibers of the material thoroughly take up the liquid.

The paper entitled "A Graphite Cathode Dish," by J. W. Turrentine, was read by title, as was the paper "Reliable Efficiency of the Arc and Resistance Furnace for the Manufacture of Calcium Carbide."

The paper entitled "Some Physical Properties of Silicon," by C. I. Zimmerman, was presented in abstract. Mr. Zimmerman indicated some interesting characteristics of silicon alloys and pointed out the necessity for careful research.

The paper entitled "Further Experiments with Calcium Alloys as Reducing Agents," by O. P. Watts and E. R. Suhn, was read by title.

The paper entitled "Electrochemical Methods of Soil Investigation," by V. K. Cameron, was abstracted by Mr. Zimmerman. The author suggests that moisture entrained in the soil gradually works out, and in this wise loosens up the chemical constituents in the soil. He also suggests that erosion and the weathering of mineral substances is due to solution rather than through corrosive action.

The paper entitled "A Modified Oxy-Hydrogen Gas Coulometer," by J. W. Turrentine, was presented.

The paper entitled "Rapid Electrochemical Analysis; a Comparison of Several Methods," by L. S. Palmer and R. C. Palmer, was read by title, as was the paper entitled "Protection of Steel Against Corrosion," by Maximilian Toch.

The paper by W. H. Walker, in answer to Professor Ganz's questions on the corrosion of iron, was not ready for presentation.

Two new papers, "Over-Voltage in Connection with the Corrosion of Metals," by W. R. Mott, and "Concentric Tubular Conductors for Heavy Currents," by C. I. Zimmerman, were presented.

Mr. Zimmerman suggests the use of concentric conducting tubes, the inner shell of the inner tube and the outer shell of the outer tube to be water-cooled.

This disposed of all of the papers scheduled, and Dr. Hering moved a vote of thanks to the local committee and the various companies which had afforded entertainment during the convention session. The convention then adjourned.

Dinner to Thomas B. Doolittle.

A number of the friends of Mr. Thomas B. Doolittle entertained him at dinner at the St. Botolph Club, Boston, on Tuesday evening, May 4. Mr. Doolittle has been identified with the Bell telephone interests since 1879, and this dinner celebrated the thirtieth anniversary of his service in the art of telephony.

At the dinner, from all parts of the world telegrams and letters of congratulation and felicitation came in, but nothing could exceed the expressions of appreciation and regard which were put forth by his old-time associates who were present on the occasion.

At this time it would not be appropriate to rehearse the achievements of Mr. Doolittle in the telephone field, because we are not now celebrating what he has done, but marking a phase of his career. To be sure, he has arrived at the age of threescore and ten, but in the language of the beloved Autocrat of the Breakfast Table, he is not seventy years old, but seventy years young. When Mr. Doolittle feels the pangs of age, and is concerned about the things that he has done, the columns of the ELECTRICAL REVIEW, the proceedings of the scientific societies, and the records of his engineering friends, will hold forth in better language than is now at our command the story of his achievements.

The gentlemen present were only a few of his old-time friends and associates, the list of guests being restricted to those who had been immediately associated with his department. The dinner was thus entirely informal and restricted. Had the list been extended to include all of the old-timers in the telephone art and those others of the electrical arts who would have been proud to join in the testimonial to Mr. Doolittle, the organizing capacity even of the officials of the American Telephone and Telegraph Company would have been overtaxed. Therefore the number of guests present was limited to those who were immediately associated with Mr. Doolittle in his work.

The activities of Mr. Doolittle were of a most important and formative character. His early conception of the importance of long-distance business was manifested in his recognition of the importance of hard-drawn copper wire in telephony. Through the opportunities afforded to him by the American Telephone and Telegraph Company he was enabled to demonstrate that by the use of this wire, long-distance telephony became a possibility. If Mr. Doolittle had in no other way contributed to the advancement of the art, this achievement, which was recognized by the Franklin Institute in conferring upon him the gold medal of merit, would entitle him to a permanent place among the pioneers in telephony.

Those present were:

J. J. Carty (who presided), T. B. Doolittle, E. J. Hall, F. P. Fish, T. Cotter, G. D. Milne, R. W. Devonshire, H. V. Hayes, C. R. Truax, S. A. Richardson, A. M. Allen, C. W. Pitman, T. B. Bailey, T. E. Pigott, W. S. Allen, A. C. Blood, F. C. Ross, J. Wyman, F. A. Buttrick, F. E. Warner, C. J. H. Woodbury, C. B. Doolittle, V. M. Berthold, J. C. T. Baldwin, A. A. Marsters and S. H. Mildram.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER IX. (PART II.)—MEASURING INSTRUMENTS.

Power-factor meters.—The power-factor, as previously explained, is the cosine of the phase angle, or the ratio of the true watts to the apparent watts, that is, the wattmeter reading divided by the product of the ammeter and voltmeter readings. It can be easily calculated but it is frequently advantageous to have an instrument for indicating its value; such an instrument is illustrated in Fig. 181.

One method of constructing such a meter is by the application of a stationary laminated iron core provided with a two or three-phase winding which is connected to the line through series transformers. The moving part consists of a soft iron vane which is acted upon by the rotating magnetic field produced by the above winding. The vane tends to rotate under this influence like the rotor of an induction motor, but is prevented by the influence of a coil connected across one of the phases. The vane then assumes the position of maximum magnetic flux. The currents in the polyphase winding are in phase with that in the line, and the current in the coil connected across one of the phases is in phase with the line voltage, so that the position of the vane will depend upon the phase relation between the line electromotive-force and the current, that is, upon the power-factor.

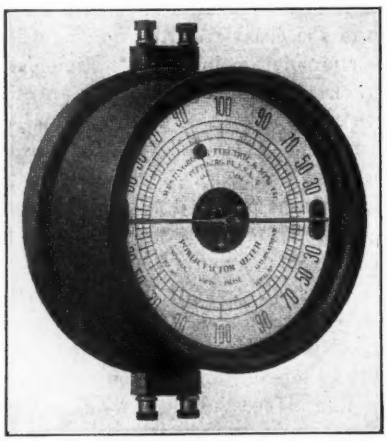


FIG. 181.—POWER-FACTOR METER FOR SINGLE-PHASE CIRCUITS.

The wattmeter.—The wattmeter is a combined voltmeter and ammeter, the influence of both being exerted simultaneously upon the same needle when of the indicating type. The usual method of construction is similar in principle to that of the electrodynamometer. One of the two interacting coils is of low resistance and constitutes the ammeter; the other, which is usually the rotating one, is of high resistance and constitutes the voltmeter. The low resistance coil, which is connected in series with the receiving circuit, is stationary. The suspended high resistance coil is connected in parallel with the receiving circuit. The interaction of the magnetic fields of the two coils is indicated by a rotation of the suspended one and its attached pointer.

Integrating wattmeters can be constructed according to the above method; they differ chiefly in that the movable coil is arranged like the armature of a motor, of which the ammeter coil constitutes the field winding and the voltmeter coil the armature winding; the recording mechanism is connected with the shaft of the armature.

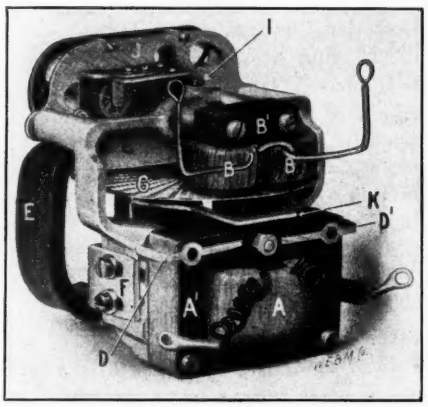


FIG. 182.—WESTINGHOUSE SINGLE-PHASE INTEGRATING METER.

Induction-type watt-hour meters.—A more recent type of integrating wattmeter and one which is particularly well suited to modern practice is that making use of principles similar to those of the induction motor.

Fig. 182 illustrates such a meter, designed for use on a single-phase circuit, and Fig. 183 is a diagram of the connections of the same meter. Both the shunt winding A and the series winding B in the former diagram are stationary and so arranged as to produce a rotating magnetic field acting upon a short-circuited rotating secondary, which in this case is the aluminum disk G.

The shunt winding A consists of a large number of turns of fine wire mounted on the iron lamination A'. It is a highly inductive circuit and its current lags approximately ninety degrees behind the line voltage. The series winding B consists of a few turns of heavy wire and has low self-induction. On non-inductive loads, such as incandescent lamps, the current through it will be in phase with the line voltage, and consequently the series magnetic field will be ninety degrees out of phase with that produced by the shunt winding. The combined effect of these two magnetic fields is to produce a shifting of the lines of force in one direction so as to generate a rotating magnetic field.

This can be better understood by reference to Fig. 183. A and A_1 represent the two poles of the shunt magnet, and C the iron core upon which the shunt coil is wound; D and B represent the two poles of the series winding. The manner in which these poles change signs by quarter periods is shown in the same figure. These signs represent the instantaneous values of the poles as seen from the rear of the meter element. As seen from the table, both the positive and negative signs move constantly to the left, indicating a shifting of the field in that direction; the process is repeated during each cycle.

This rotating field induces eddy currents in the aluminum disk and the latter rotates just as does the rotor of an induction motor under the influence of the rotating magnetic field. In this case the rotating field is a combination of a shunt or voltmeter field and a series or ammeter field and the torque of the moving disk is proportional to their product, or the energy of the circuit. True power will be recorded whether the load be inductive or non-inductive.

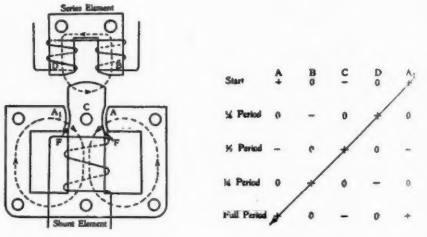


FIG. 183.—PRODUCTION OF ROTATING FIELD IN ALTERNATING-CURRENT WATT-HOUR METER.

In order to obtain proportional rotation it is necessary that there be a retarding torque, that is, that the motor have a load. This is accomplished by causing the rotating disk to pass between two permanent magnets, one of which is shown at E in Fig. 182. The eddy currents induced in the disk by these permanent magnets tend to prevent the rotation of the former. This is the method of obtaining a retard-

ing torque on nearly all makes of integrating watt-hour meters.

As already stated, the shunt and series circuits of the meter illustrated are assumed to be ninety degrees out of phase with each other. Although nearly so, they are not exactly that amount, due to the copper and iron losses in the shunt circuit. These can be neutralized, however, by placing a short-circuited turn or

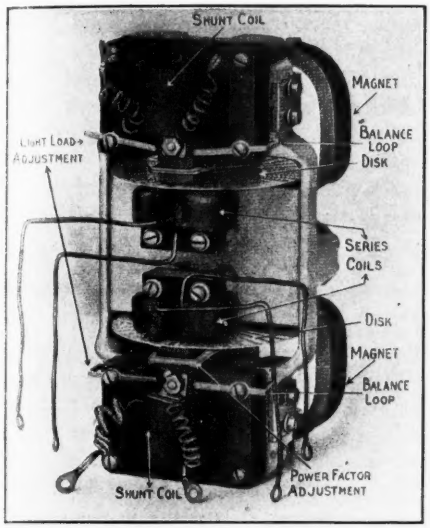


FIG. 184.—WESTINGHOUSE POLYPHASE INTEGRATING METER.

secondary around the pole C of Fig. 183. This is shown by K in Fig. 182. By raising or lowering this turn the magnetism of the shunt field can be shifted to such an angle that the shunt and series field magnetizations are practically ninety degrees out of phase with each other.

Measurement of power in polyphase circuits.—It is possible to measure the power delivered by a polyphase system by means of one wattmeter, just as in the single-phase system, and then multiplying this reading by the number of phases, provided the load is balanced, that is, equally distributed among all the phases. In practice this is not usually the case. The power can then be measured by inserting the wattmeter in each phase in turn and taking the sum of the separate readings. This method is not always convenient, and there is no assurance that the load has remained constant during the readings.

The total power delivered by a two or three-phase system can also be measured by means of two wattmeters if their current coils are placed in two of the mains and their voltage coils connected from each of these two mains to the common return of a three-wire, two-phase system or to the third main in either a Δ or Y-connected three-phase system. The total power is either the sum of or the difference between the two readings, to be determined as follows: One of the wattmeters is disconnected and the other put in its place, leaving the same pressure-coil terminal connected to the third main as before, and connecting the series-coil terminals in the same manner as at first; if the indicating needle is deflected in the same direction as before, the readings are to be added; if in the opposite direction, they are to be subtracted.

Polyphase watt-hour meters.—The principles just outlined for indicating wattmeters apply also to integrating meters for measuring polyphase power. Two

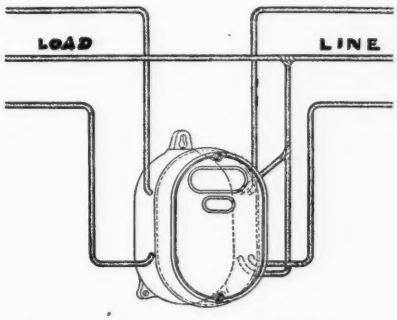


FIG. 185.—METHOD OF CONNECTING POLYPHASE WATTMETER.

wattmeters may be combined so that the total power is read directly as shown in Fig. 184, where the two discs operate a common shaft and integrating mechanism.

The method of connecting a polyphase watt-hour meter to a three-phase system is shown in Fig. 185. If the voltage is high, potential transformers are inserted and, if the current is large, series transformers are inserted, as shown in Fig. 186.

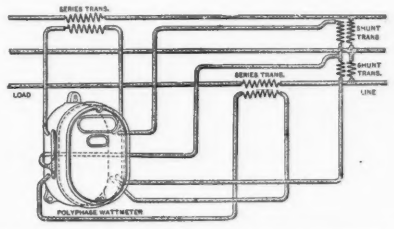


FIG. 186.—USE OF SERIES AND POTENTIAL TRANSFORMERS WITH POLYPHASE WATTMETER.

This practice not only increases the sensibility of the meter by reducing its bulk, but has the further marked advantage of removing all its circuits from immediate contact with the high-tension lines.

Graphic recording instruments.—Instruments for indicating the value of various electrical quantities at any instant have already been described, as have instruments for summing up or integrating the amount of energy consumed. It is also possible to design instruments for recording graphically the change of the values of electrical quantities with time. Fig. 187 illustrates a recording frequency meter. The roll of paper is moved by clockwork, and the pen traces the value of the frequency. The paper may be

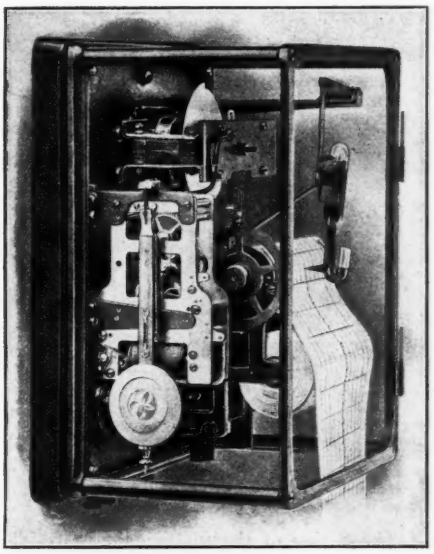


FIG. 187.—GRAPHIC RECORDING FREQUENCY METER.

marked by lines representing the time at right angles to those representing the value of the frequency, so that a continuous record of the value of the frequency is obtained. The clock shown in the foreground of the illustration rotates the roll of paper at the proper speed and is self-winding. At definite intervals of time it makes contact with the electric circuit which rewinds the spring, so that as long as there is current available the mechanism will not stop. In some instruments of this type the record is made on a circular chart.

Ammeters, voltmeters, wattmeters and power-factor meters are also made to give a graphic record for filing away. The value of such records to a station manager particularly is incalculable in keeping tab on the character and amount of the station output.

The oscillograph.—Under certain conditions the alternating-current curve has the form of a sine curve, as previously illustrated. In actual practice these conditions are only approximately attained. An instrument for showing graphically the exact form of an electric wave is known as an oscillograph and is a modified form of D'Arsonval galvanometer. The essential features of such an instru-

ment are illustrated in Fig. 188. N and S are the poles of a powerful magnet between which are stretched the two parallel conductors *s s*, formed by passing a strip of phosphor-bronze over the pulley P and attaching the ends to the terminals at K.

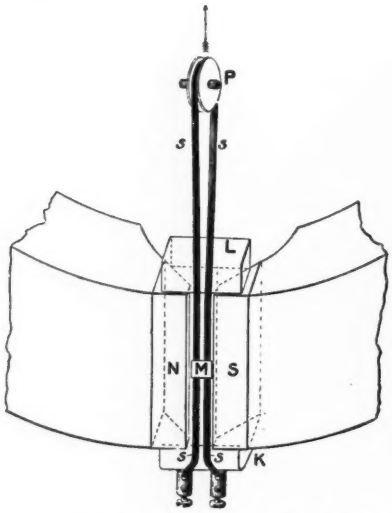


FIG. 188.—ADAPTATION OF D'ARSONVAL GALVANOMETER TO DUDDELL OSCILLOGRAPH.

The action of the instrument is as follows: On passing an electric current through the strips, one of them will advance, while the other recedes, depending on the direction of the current. As the current reverses, the action will be reversed, so that the attached mirror M is oscillated about a vertical axis. In the high-frequency instrument, the natural period of vibration of the strip is one-

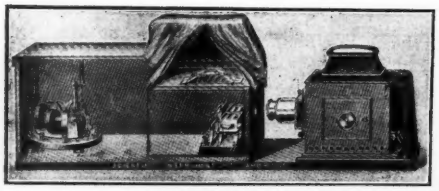


FIG. 189.—DUDDELL OSCILLOGRAPH OUTFIT.

ten-thousandth of a second, and as the space between the poles is filled with oil to dampen the movement of the strip, accurate results can be obtained when the periodicity of the current to be tested is over 300 periods per second. When a beam of light is reflected from the mirror the oscillating mirror causes the spot of reflected light falling upon a screen to oscillate to and fro. If the screen be moved back and forth at right angles to the direction of the beam and that in which the spot oscillates, the form of the curve is shown, due to the persistence of vision. When a record of the curves is desired a photographic film may be rotated so that an imprint of the moving spot of light can be obtained thereon.

An outfit for accurately observing wave form is illustrated in Fig. 189, which shows a Duddell oscillograph at the left, the lantern for producing the beam of

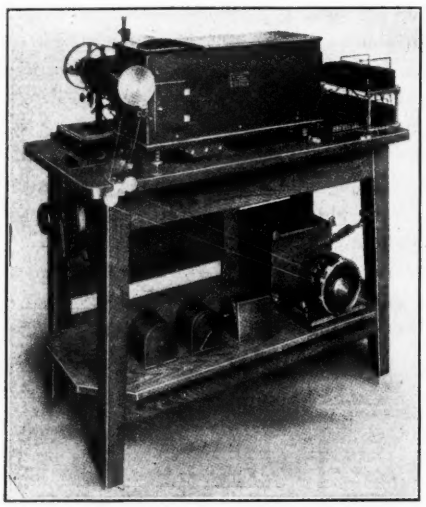


FIG. 190.—GENERAL ELECTRIC OSCILLOGRAPH OUTFIT.

light at the right and in the center a synchronous motor and vibrating mirror which reflects the beam coming from the oscillograph to the curved screen. Fig. 190 shows an oscillograph outfit made by the General Electric Company.

Curves taken by the oscillograph are illustrated in Fig. 191, which represents both the current and potential curves of a double-carbon alternating-current arc

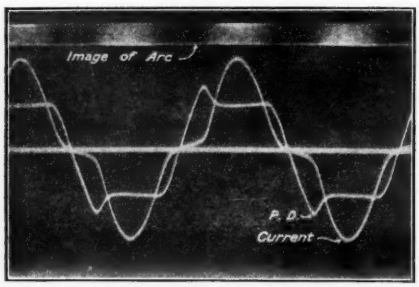


FIG. 191.—CURRENT AND POTENTIAL OSCILLOGRAMS OF DOUBLE-CARBON ALTERNATING-CURRENT ARC.

lamp. These superimposed curves are obtained by use of a double oscillograph, one set of strips acting as a voltmeter and the other as an ammeter. These instruments are now commonly made up with three galvanometer elements, so that a record of three waves may be obtained simultaneously and superposed. Curve records obtained from an oscillograph are called oscillograms.

Encouraging Power Development in Mexico.

According to a recent consular report, the Mexican Petroleum Company is empowered to utilize water from the River Tamesi, in the state of San Luis Potosi, to an extent not exceeding twenty-eight litres per second, for the requirements of the company's industry at Ebano. The construction of the works must be begun within two years and be completed within seven years from the same date. The company is granted the right to import, free of duty, all machinery, scientific instruments and apparatus necessary for the survey, construction and subsequent use of the works.

Electric Steel Furnace in Belgium.

The Cockerill Company has recently started an electric furnace on the Girod system at their steel works in Liege, Belgium. The furnace, which has a charging capacity of from two to three tons of steel, is supplied with alternating current at fifty volts from a generator driven by gas engines, operating with blast-furnace gas. The electric furnace is placed in a specially constructed building in close proximity to the steel converters.

Claims 5,000 Inches of Water.

Dr. A. H. Tickell of Nevada City, Colo., has filed a claim for 5,000 inches of water in the Middle Yuba River with the recorder of Nevada County, Colorado. He says he will erect a large electric power plant on the stream at a point above the dam used by the Plumbago Mining Company, and will take in all the water in the stream. He intends to build on the Nevada County side of the river a plant which will generate at least 500 horsepower.

Trolley Lines and Freight.

Joseph A. Messiroff, engineer for the proposed Milwaukee & Fox River Valley Railroad Company, which has been asking a certificate of necessity and convenience, recently testified before the Wisconsin state railway rate commission regarding the investigation which he and Attorney Oscar M. Fritz of Milwaukee conducted on freight-carrying lines in Illinois and Indiana.

Mr. Messiroff said that the more freight the roads carry the better paying they are.

The proposed road running north of Milwaukee will be 135 miles in length and will have its northern terminus in Appleton.

Chicago Electric Club.

At the meeting of the Chicago Electric Club held Wednesday noon, May 5, F. J. Postel, chairman of the civic committee, reported some resolutions relative to the Kleeman bill, House bill No. 504, now pending before the Illinois Legislature, which aims to restrict the sale of current by the Sanitary District of Chicago to municipal bodies only. These resolutions condemned the bill as being needlessly restrictive and superfluous.

The speaker announced for the meeting was W. L. Stockton, manager of the turbine sales department of the Western Electric Company, who took for his subject "The Exhaust-Steam Turbine." He declared that this turbine came nearer to being a machine that gives its purchaser something for nothing than anything that has come to his knowledge. He said that steam used in a reciprocating engine at 150 pounds boiler pressure has a temperature at entry to the engine of about 240 degrees, and, if operating non-condensing, is exhausted at about 215 degrees; if it is exhausted at a twenty-eight-inch vacuum, its temperature is about 103 degrees. The exhaust-steam turbine thus enables us to get this added amount of energy from the steam.

In many plants the capacity has been increased by 100 per cent without additional fuel cost by adding the exhaust-steam turbine and condenser. Mr. Stockton cited the case of a plant having a 450-kilowatt Corliss-engine-driven unit which, by the addition of an exhaust-steam turbine and condenser, had its capacity increased by a 450-kilowatt generator driven by the turbine.

The exhaust turbine has been used heretofore mostly for engines operating on fairly stable load and thus giving a quite steady steam supply. Lately it has been used with engines having greatly fluctuating loads, such as hoisting and rolling-mill engines; this is accomplished by adding a regenerator, which may be termed a steam flywheel. The speaker stated that this type of prime mover is also highly desirable for use with engines operating on railway loads; in fact, he declared, it is cheaper than the installation of a storage battery. However, the exhaust turbine is not a panacea for all the station manager's troubles, but is a means for enlarging the capacity of the plant with a low investment charge and at a trifling operating cost.

At the conclusion of Mr. Stockton's remarks there was a discussion, in which participated S. G. Hobert, G. H. Lukes, T. G. Grier, D. W. Roper, J. W. Mabbs and G. C. Keech. In reply to questions, Mr. Stockton made it clear that the field of the exhaust-steam turbine is necessarily limited to such installations where condensing facilities are readily available. He also noted that among recent plants that have adopted this type of turbine is the Chicago & Northwestern Railway, which will have reciprocating-engine units operating in conjunction with low-pressure turbines in its new depot now in construction in Chicago.

An interesting possible application of this type of turbine was brought out at the close of the meeting in which it was suggested that some ingenious inventor might devise a means of using an exhaust-steam turbine in connection with a steam locomotive, thereby increasing its capacity very greatly.

Chicago Telephone.

General Manager Angus S. Hibbard, of the Chicago Telephone Company, says the company has invested more than $31,000,000 in its plant, and the growth of business will require an investment of $3,000,000 to $5,000,000 each year for many years.

The company's buildings here cover eight-and-one-half acres and contain over 6,200,000 cubic feet of space.

"During the sixteen months since the new ordinance was passed," says Mr. Hibbard, "we have handled in the city 59,044 'in' orders; 31,183 telephones have been ordered out, and 25,300 miscellaneous orders have been handled, making a total of 166,068, or 399 for each working day.

"The wire plant increased 90,000 miles to 473,334 miles, of which eighty-six per cent is underground cables. We operate thirty-one separate exchanges in the city, including thirteen neighborhood exchanges. Our employes number 8,100.

"In territory around Chicago we operate 50,000 telephones in 110 exchanges.

"A recent careful search failed to find any place east of the Rockies with 300 inhabitants within 500 miles which did not have direct telephonic communication with this city."

Boston Elevated—West End.

The Massachusetts House has passed to be engrossed, without debate, a resolution which has been acted upon unanimously by the Senate, providing for investigation by the railroad commission and Boston Transit Commission of certain matters relative to the West End Street Railway Company and the Boston Elevated Railway.

The resolution provides that the two commissions investigate and report to the general court on or before the second Saturday in January, 1910, whether it is advisable:

1. To amend chapter 551 of acts of 1908, providing for distribution of any of the assets of the West End Street Railway among stockholders, or by changing terms and conditions of the first and second preferred stock to be issued by the Boston Elevated, and if so, in what manner and extent.

2. To authorize the Boston Elevated to acquire securities of other street railways, elevated railroads or electric railroads, and if so, under what conditions and limitations.

3. To authorize the Boston Elevated to extend its elevated railroad from Sullivan Square to Medford, and if so, under what conditions and limitations.

Franchise for the Hudson & Manhattan Railroad.

The granting of a franchise to the Hudson & Manhattan Railroad Company for its proposed extension of the McAdoo Subway to Grand Central Station, New York city, was approved by the New York State Public Service Commission on May 4, and the chairman and secretary were authorized to execute the contract with the company in accordance therewith. The franchise contract provides for an extension of the present subway in Sixth Avenue from Thirty-third Street to a point near Fortieth Street, thence by a curve to Forty-second Street, thence to a terminal station on Forty-second Street between Madison and Lexington avenues, with three stations, one at Sixth Avenue and Thirty-eighth Street, one at Forty-second Street and Fifth Avenue, and the terminal station between Madison and Lexington avenues. The company is required to begin construction within six months after it shall have obtained all necessary consents and to complete construction within three years after such construction is begun.

The Board of Estimate and Apportionment has, under the terms of the rapid transit law, sixty days within which to pass upon the franchise; and before it is made effective it must also have the mayor's approval.

The Hudson & Manhattan company accepted the franchise within twenty-four hours, and on May 7 it was presented to the Board of Estimate by the mayor.

THE USE OF LARGE GAS ENGINES FOR GENERATING ELECTRIC POWER.[1]

BY LEONARD ANDREWS AND REGINALD PORTER.

In last week's issue the question of the yield of sulphate of ammonia and the profit in it was being considered.

One ton of sulphuric acid, costing $7.50 per ton, is required for each ton of sulphate of ammonia, and the cost of bags for packing the ammonia is estimated at thirty-six cents per ton. The cost of acid and bags will therefore be $4,610, reducing the total amount to be credited on account of sale of sulphate of ammonia to $27,620.

The cost of oil for the steam-turbine plant is estimated at 0.006 cent per kilowatt-hour generated. The oil consumption for large gas-driven generators is stated by different authorities to be from 0.2 to 0.37 gallon per 1,000 horsepower-hours, the average cost of the oil used being thirty-six cents per gallon. Taking the higher figure, the oil consumption per plant unit will be:

0.4 gallon per hour, or..$4,850 per hour
The cost of the oil for the auxiliary plant is estimated at ..... 1,000 per annum

$5,850 per annum

The cost of waste and engine-room stores is estimated at 0.004 per cent unit generated for both the steam plant and for the gas plant, thus bringing the total cost of oil, waste and stores to $2,190 for the steam plant, and to $6,725 for the gas plant.

Each steam unit requires 288,000 gallons of cooling water per hour, of which it is estimated three per cent will be evaporated from the cooling towers. The water evaporation will therefore be 8,640 gallons per hour × 12,800 engine-hours, or 110,500 thousand gallons per annum at twelve cents per thousand gallons = $13,800 per annum.

The cooling water required for the gas engines is found to be about twelve gallons per hour per kilowatt output; each 1,500-kilowatt plant will therefore require 18,000 gallons per hour. Again, assuming an evaporation of three per cent, the water evaporated from the engine cooling towers will thus be 540 gallons per engine-hour × 17,450 engine-hours = 9,500 thousand gallons per annum. The water consumption for the producers is estimated at 35,000 gallons per day = 12,700 thousand gallons per annum. The total water for the gas plant will therefore be 22,200 thousand gallons at twelve cents per 1,000 = $2,775.

The labor charges are calculated upon the assumption that the following staff would be required for the respective schemes:

STEAM PLANT.

Three charge engineers at $15 per week..	$ 45.00
Three switchboard attendants at $7.50 per week	22.50
Four drivers at $8.75 per week.....	35.00
Four assistant drivers or cleaners at $7 per week.....	28.00
Three firemen at $8.75 per week.....	26.25
Nine boilerhouse and auxiliary plant hands at $7.50 per week.....	67.50
Three men for unloading coal and removing ashes at $7 per week.....	21.00
Total	$245.25

Total labor charges per annum, $12,750.

GAS PLANT.

Three charge engineers at $15 per week.	$ 45.00
Three switchboard attendants at $7.50 per week	22.50
Six drivers at $8.75 per week.....	52.50
Five drivers at $7.50 per week.....	37.50
Two cleaners at $7 per week.....	14.00
Three producer hands at $8.75 per week.	26.25
Six producer hands at $7 per week.....	42.00
Seven ammonia recovery hands at $7.50 per week.....	52.50
Two men for unloading coal and removing ashes at $7 per week.....	14.00
Total	$306.25

Total labor charges per annum, $15,900.

MAINTENANCE AND REPAIRS.

This is the most difficult item to estimate with any degree of accuracy for either the steam or gas plant. It is practically useless citing experience of existing stations, as the conditions in no two are alike. It is, for instance, quite possible to quote cases where, either through faulty design or construction of the plant or from some other cause, gas engines have been a continual source of trouble, and it is equally possible to give numbers of cases where large gas-driven electric generators have been running for years with remarkably low charges for maintenance and repairs.

The same may be said of steam-turbine installations.

The better way to arrive at an approximate conclusion as to what should be allowed for this item is to consider what are the conditions in the respective cases which are liable to lead to trouble.

Taking steam turbines first, the principal risk appears to be that of the blades stripping. While the large number of steam turbines that have now been running for some years without any serious trouble of this nature would appear to indicate that this risk is small, the fact must be faced that cases have occurred, even with turbines erected during the past twelve months, where heavy repair charges have been incurred by loosening and stripping of the turbine blades.

With large gas engines, the most serious risk is that of the fracture of the piston or of the cylinder liners. Troubles of this nature, however, while somewhat frequent in some of the earlier large gas engines, owing to makers not having had experience to enable them to so design these parts as to reduce the expansion and contraction under wide ranges of temperature to a minimum, are fast disappearing.

As far as the actual wear and tear of the moving parts is concerned, this will probably be smaller in a gas engine than in a steam turbine. Practically the whole of the weight of the pistons and piston rods is carried on heavy side blocks external to the engine cylinder. The wear upon the cylinder liners is, therefore, extremely small, being only that due to the compression of the piston rings against the liners.

Numbers of examples are recorded of large engines in Continental generating stations that have been running for twelve or eighteen months without being opened out.

The repairs of generators would certainly be lower for a gas-driven plant than for a steam or turbine-driven plant.

One of the principal items in the maintenance of a steam station is that of the repairs of steam pipes, whereas the maintenance of pipework in connection with a gas station will obvously be extremely small. In the first place, the working pressure is only one or two inches above atmospheric pressure. There is consequently no danger of joints leaking if the pipes are once properly installed. Again, as no steam-pipe lagging is required for the gas pipes, an appreciable item of expense in maintaining these is entirely eliminated.

The principal liability, of repairs to pipework, appears to arise from the risk of the exhaust pipes being attacked by sulphuric acid if the water is allowed to mix with the exhaust gases and combine with the small percentage of sulphur in them.

The cost of producer repairs appears to be a very small item, and will undoubtedly be only a fraction of the cost of repairs to high-pressure steam boilers. It has been estimated that the total cost of repairs to the entire producer plant, including the ammonia-recovery appliances, would not exceed on the average $2,500

[1]Abstract of a paper read before the Institution of Electrical Engineers at London on February 11, and at Manchester on February 16, 1909.

per annum over a period of several years. The authors are of the opinion that the total cost of repairs for the 10,000-kilowatt gas-driven station, including engines, generators, producers, all auxiliaries and buildings, would not exceed $20,000 per annum.

They have also estimated the repairs and maintenance of the steam plant at the same rate as the gas plant, though it is believed that this is a lower figure than has yet been obtained in any steam station over a period of several years.

ANTIQUATION, DEPRECIATION AND INTEREST.

As the use of large gas engines is so comparatively new in this country, some engineers may be inclined to think that the designs will be so altered during the next few years as to make it necessary to set aside a large amount to provide against antiquation. Those, however, who have visited many of the large gas-engine installations on the Continent will have been impressed by the great similarity in general design between all the engines that have been erected during the past three or four years. Several members of the party who recently visited the very fine gas installation at the Homecourt Iron and Steel Works were particularly impressed by the fact that they saw engines running side by side bearing various dates from 1904 to 1907. These engines appear to be identical in every respect, and they have been maintained in such excellent order that the earlier engines appear to be running in every way as satisfactorily as those of more recent date. The entire absence of vibration in connection with these engines (it has been found possible to balance a penny on edge on the cylinder of a 2,000-horsepower engine running on load) would appear to indicate that in all probability these engines will be running as well twenty years hence as they are today.

The correct amount to allow for interest and depreciation on electric generating machinery is a somewhat debatable point. It is usual, in preparing estimates for industrial plants, to allow ten per cent, but Mr. Snell, in his paper on "Cost of Electrical Power for Industrial Purposes," justifies the figure of 6.25 per cent.

As this point has a very important bearing on the comparison of steam and gas-engine cost, the authors have in each case shown the comparative cost, including these charges, at ten per cent, and alternately at 6.25 per cent.

The total running costs of generating 21,000,000 units under the above conditions will, it is estimated, be respectively as follows:

	Gas.	Steam.
Total cost of coal at 12s. per ton	$ 61,400	$ 99,840
Less sale of sulphate of ammonia	27,620	.....
Net cost of coal	$ 33,780	$ 99,840
Oil, waste and stores	6,725	2,190
Water	2,775	13,300
Labor	15,900	12,750
Repairs	20,000	20,000
Interest and depreciation at 10 per cent on capital	88,435	69,760
Total cost	$167,615	$218,340
Total cost per unit in cents	0.766	0.996
Total cost, allowing 6¼ per cent for interest and depreciation	$134,500	$192,140
Total cost per unit in cents	0.612	0.876

The total cost (including 6.25 per cent for interest and depreciation) of generating power by steam is forty-five per cent greater than the cost of generating by gas.

EFFECT OF PRICE OF COAL AND LOAD FACTOR.

In the particular case considered the conditions are more favorable to the use of gas engines than in many of the existing provincial municipal electric-supply schemes in this country. There are at present only fifteen public electric supply undertakings working at a load factor of over twenty-four per cent, though many more have load factors varying from twenty to twenty-four per cent. In many cases, too, a suitable coal can be obtained at less than $3 per ton delivered at the works. The authors, therefore, go to the opposite extreme, and consider the case of a generating station having the very poor load factor of ten per cent, and able to obtain fuel at $2 per ton. They also assumed that the maximum output is only 4,000 kilowatts, and that the use of an ammonia-recovery plant for a portion of the producer plant, as in the scheme previously considered, is not justifiable. Under these conditions the saving in fuel effected by using gas engines is little more than sufficient to pay the ten per cent interest and depreciation charges on the higher capital outlay of the gas plant.

It has been suggested that for such conditions a combined gas and steam plant might be used, the gas plant being utilized for the long-hour portion of the load curve and the steam plant with its lower capital charges for the peak load.

The following table shows the estimated annual running costs with plants consisting, respectively, of—

A. Five 1,000- kilowatt steam turbo-generators.

B. Seven 700-kilowatt gas engines and generators.

C. Four 1,000-kilowatt steam turbo-generators and two 700-kilowatt gas engines.

TABLE OF RUNNING COSTS FOR A 4,000-KILOWATT PLANT. TEN PER CENT LOAD FACTOR. COAL, $2 PER TON.

	A. Steam.	B. Gas.	C. Combined.
Coal	$19,580	$10,365	$13,955
Oil and waste	475	1,485	1,240
Water	3,550	500	850
Labor	12,000	12,500	13,725
Repairs	6,250	6,250	6,250
Interest and depreciation at 10 per cent	37,260	47,890	43,195
Total	$79,115	$78,990	$79,215
Total cost, including interest and depreciation at 6¼ per cent	65,185	61,045	63,040

It appears, therefore, that for the above conditions and a ten per cent charge for interest and depreciation, there is nothing to choose between the different types of plant as far as running cost is concerned, but with interest and sinking-fund charges of 6.25 per cent, the combined station shows an over-all economy of three per cent over that of the steam plant, and the all-gas plant an improved economy of six per cent over the all-steam plant.

From a great many similar calculations it can be seen that under no condition is it worth while, when building a new station, to install a combination of steam and gas plant. With a non-recovery plant and coal above a certain price, a gas plant is more economical, and below that price, a steam plant alone is more economical than either a gas plant alone, or than combined steam and gas.

These remarks apply only to entirely new installations. There are, however, many existing installations equipped with a comparatively inefficient plant, where a large economy would be effected by installing one or more gas engines, which would be used for the flat portion of the curve, the inefficient plant being retained for the peak load and standby.

It will also be seen that if the size of the installation or the load factor permits of a recovery plant being used, a gas plant is more economical than a steam plant, however low the price of coal.

Petitions for New Subway.

The New York State Public Service Commission received on May 7 a petition from the Metropolitan Opera and Real Estate Company and other owners of property on the west side of Manhattan Borough, New York city, asking for a four-track subway in Seventh Avenue over the route adopted by the old Board of Rapid Transit Commissioners, with certain exceptions. The petition was referred to the committee considering Manhattan subway projects.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

GEORGIA RAILWAY AND ELECTRIC COMPANY.

Curtis & Sanger, in connection with Blodgett, Merritt & Company and Spencer, Trask & Company, have placed $1,000,000 Georgia Railway and Electric Company refunding and improvement sinking fund gold five per cent bonds, dated January, 1909, and due January, 1949, at ninety-six and interest. These bonds are a part of an authorized issue of $20,000,000. A sufficient amount of the $20,000,000 issue will be reserved to retire all underlying bonds, amounting to $11,000,000. The balance can be issued from time to time to pay for improvements and extensions up to seventy-five per cent of actual cost. The issue of $1,000,000 was made to take up floating debt and improvements, and the company is now free from all debt save current accounts. For the year ended December 31, 1908, the company earned net $1,457,365 over all expenses in taxes, which included interest charges of about $600,000. The company earned about nine per cent upon its common stock last year, and earnings for the first three months of 1909 showed a gross increase of $61,641 over the same period a year ago, and a net increase of $47,128.

CHICAGO RAILWAYS.

The Chicago Railways Company has issued a statement of income covering the two months of February and March, 1909. The separate statements follow:

February:		
Passengers	$850,200	$742,826
Other income	20,520	16,116
Total gross	$870,720	$758,942
Expenses	624,247	564,837
Balance (actual)	$246,472	$194,104
Balance	261,216	227,682
Deduct interest, 5 per cent on valuation	162,530	135,787
Net income	$ 98,685	$ 91,894
City of Chicago, 55 per cent	54,277	50,542
Chicago Rys. Co., 45 per cent	44,408	41,352
March:	1909.	1908.
Passenger	$965,655	$840,743
Other income	22,272	16,989
Total gross	$985,927	$857,732
Expenses	690,909	608,310
Balance (actual)	$295,017	$249,422
Balance, based on 70 per cent for operation	295,778	257,319
Deduct interest, 5 per cent on valuation	166,310	136,064
Net income	$129,467	$121,254
City of Chicago, 55 per cent	71,207	66,690
Chicago Rys. Co., 45 per cent	58,260	54,564

MONTREAL LIGHT, HEAT AND POWER.

Announcement comes from Montreal that an increase in the Montreal Light, Heat and Power Company's dividend to a seven per cent rate is expected in August next. The fiscal year of the company closed April 30, and it is reported that the company will show a surplus of $700,000.

NEW ENGLAND TELEPHONE.

The full pamphlet report of the New England Telephone and Telegraph Company for 1908 has been issued. In his remarks Mr. Sherwin, president of the company, says that the average patronage was nearly 1,000,000 calls a day, the exact figures being 301,600,000 local and 15,800,000 toll calls for the year. The report also says: "Last year only 13,737 stations were added, owing to a restrictive policy induced by the unsettled conditions of business. For 1909, however, an increase of 25,000 stations is expected."

In the four northern New England states in which it operates, the system of which it is the center, at the end of 1908 had 304,896 telephones connected therewith, a number since increased to over 312,000. For the past year or more the Massachusetts Highway Commission has been making a study of the affairs of this company, and only recently published its inventory. From this it appears that the appraisal value of its property is $46,540,819, while its total outstanding liability in the form of stocks, bonds and notes is only $38,939,850. The report also points out that in the past ten years, despite the advance in the rate of wages and the cost of material, economies in operation and improvements in the art have enabled various rate reductions, in consequence of which the revenue per station has dropped from an average of $71.13 to $34.70.

With reference to the purchase of the Northeastern Telephone Company, the Lewiston & Auburn Telephone Company and the Cumberland Telephone Company, in Maine, it appears that stocks and bonds aggregating $1,571,000 were purchased for $403,000. Among other statistics of development during the year appears a statement regarding the amount of conduit construction by the company, by which it appears that it already has, underground, a total of more than 3,000 miles of duct.

UNITED GAS IMPROVEMENT.

Net profits of $6,326,707 during the last calendar year were announced in President Dolan's report to the annual meeting of the United Gas Improvement Company. This was a gain of $325,561 over the previous year. After paying out $3,670,788 in dividends the company invested $678,500 in sinking funds and carried $1,977,419 to undivided-profit account, which now aggregates $21,437,179. The balance sheet shows assets of $68,006,699, of which $61,218,492 is represented by investments in gas, electric, street-railway, Welsbach and other companies, and $3,671,625 by cash. The capital stock is placed at $45,884,850.

The stockholders unanimously approved the recommendation of the directors that the capital stock be increased from 918,000 shares to 1,009,467 shares. The new issue will be offered to shareholders at par, $50 to the extent of ten per cent of their holdings, and will net the company $4,573,000, which will be used in construction work by companies in which the United Gas Improvement is a shareholder. In the absence of President Dolan, who is ill, Samuel T. Bodine acted as chairman at the meeting. Officers were re-elected as follows by the vote of 682,657 shares: President, Thomas Dolan; directors, Samuel T. Bodine, Randal Morgan, Clement A. Griscom, Rudolph Ellis, William Wood and Morris L. Clothier.

UNITED RAILWAYS INVESTMENT.

At the annual meeting of the United Railways Investment Company the report for the fiscal year ended December 31, 1908, was presented, showing a surplus of $265,045, a decrease of $163,089.

President Thalmann said that if earnings of the company continue to increase during the current year the company should have a considerable surplus over and above the dividend on its first preferred stock, which will be available for dividends on its ordinary preferred stock. In view of requirements of the company for further facilities to meet its increasing business, he says, there will probably be no cash dividends declared during the current year.

The income account for the fiscal year ended December 31 last, in comparison with the previous year, is as follows:

	1908.	Changes.
Dividends on stock owned	$1,452,672	†$ 5,100
Interest on loans and ac. rec.	106,118	*3,026
Total income	$1,558,790	†$ 2,074
General expenses, etc.	50,586	†17,053
Interest and discounts	1,243,159	*152,568
Total charges and expenses.	$1,293,745	*$135,515
Net income	$ 265,045	†$137,589
Adjustments (cr.)	.....	†25,550
Surplus	$ 265,045	†$163,089
Previous surplus	824,916	*428,134
Profit and loss surplus	$1,089,961	*$265,045

*Increase. †Decrease.

The combined income account of the Philadelphia Company (controlled by the United company) and affiliated corporations for the twelve months ended Decem-

ber 31 last, compares with the previous year as follows:

	1908.	Changes.
Gross earnings	$16,576,262	†$2,505,837
Oper. expenses and taxes.	8,681,133	†987,195
Net earnings	$ 7,895,129	†$1,518,642
Other income	246,670	†3,537
Total income	$ 8,141,799	†$1,522,179
Deductions	1,372,900	*84,216
Balance	$ 6,768,899	†$1,606,395
Fixed charges	3,340,620	*26,386
Net income	$ 3,428,279	†$1,632,781
Impmts, bttmts, etc.	782,978	†1,353,718
Balance	$ 2,645,301	†$ 279,033
Cum. preferred dividends..	379,780	*6,447
Balance	$ 2,265,521	†$ 285,480
Prop. aplbl. other hold. stocks	3,645	*642
Surplus	$ 2,261,876	†$ 286,122
Prop. aplbl. to U. R. I. Co. (72.80 per cent)	1,646,646	†208,296

*Increase. †Decrease.

The annual meeting of the Philadelphia Company has been postponed for one month.

LEXINGTON & INTERURBAN.

The report of the Lexington & Interurban Railway Company for the month of March and three months ended March 31 compares as follows:

	1909.	1908.
March gross	$ 40,957	$ 43,985
Expenses	34,703	31,380
March net	$ 6,254	$ 12,605
Three months gross	119,725	120,955
Expenses	94,773	87,974
Three months net	$ 24,952	$ 32,981

EDISON ELECTRIC ILLUMINATING OF BROOKLYN.

The Edison Electric Illuminating Company of Brooklyn and the New York & Queens Electric Light and Power Company report as follows to the Public Service Commission for the half-year ended December 31, 1907:

	Edison Electric.	N. Y. & Q. Electric.
Rev. sales of electric current.	$1,745,316	$249,314
Net income	857,648	84,296
Total reductions	679,774	66,769
Net corporate income	177,874	17,527
Surplus, June 30, 1907	*8,680	181,271
Total surplus	186,555	198,798

*Adjustment of accounts of previous six months.

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of March and three months ended March 31 compares as follows:

	1909.	1908.
March gross	$217,872	$201,129
Expenses	124,076	114,880
March net	$ 93,796	$ 86,249
Other income	159	1,058
Total income	$ 93,955	$ 87,307
Charges	70,942	68,899
March surplus	$ 23,013	$ 18,408
Three months gross	657,181	625,967
Expenses	372,025	356,269
Three months net	$285,156	$269,698
Other income	350	2,656
Total income	$285,506	$272,354
Charges	212,866	205,952
Surplus	$ 72,640	$ 66,402

ROCHESTER RAILWAY AND LIGHT.

The Rochester Railway and Light Company reports for the year ended December 31, 1908, compared as follows:

	1908.	1907.
Gross	$2,502,034	$2,364,290
Expenses	1,262,929	1,158,174
Net	$1,239,105	$1,206,116
Other income	194,217	193,440
Total net	$1,433,322	$1,399,556
Charges	823,388	764,150
Surplus	$ 609,934	$ 635,406
Previous surplus	407,834	296,738
Total surplus	$1,017,768	$ 932,144

KANSAS CITY RAILWAY AND LIGHT.

The report of the Kansas City Railway and Light Company for the month of March and ten months ended March 31, 1909, compares as follows:

	1909.	1908.
March gross	$ 548,061	$ 483,741
Expenses	303,887	267,037
March net	$ 244,174	$ 221,704
Charges and taxes	154,370	153,824
March surplus	$ 89,804	$ 67,880
Ten months gross	5,397,181	5,127,918
Expenses	3,054,437	2,658,672
Ten months net	$2,342,744	$2,469,246
Charges and taxes	1,544,973	1,532,895
Ten months surplus	$ 797,771	$ 936,351

THIRD AVENUE EARNINGS.

In the year ended April 1 the earnings of the Third Avenue Railway system, New York city, increased $500,000, according to Frederick W. Whitridge, receiver, who placed the increased number of fares in that time at approximately 10,000,000. He said it was impossible as yet to determine to what extent the pay-as-you-enter cars figured in this new business.

"Times are better," he said, "the service of the road is better, the cars are cleaner, the system by which they are operated through the different sections of the city has been improved, better time is now made, there is no 'knocking down' fares by conductors, and few passengers ride for nothing.

"The last two improvements are directly caused by the installation of the new pay-as-you-enter cars, but obviously all the credit cannot be placed to them.

"I believe that the total number of fares 'knocked down' by dishonest men amounted to a considerable item in the course of a month. Another loss was accasioned by passengers on crowded cars keeping their nickels in their pockets and deliberately stealing rides.

"In the first three days after the stoppage of the transfers the road lost 60,000 passengers. Then gradually we changed our lines, and we have now so overhauled our system of operation that the Third Avenue lines run direct to places heretofore covered by transfers.

"We have taken off cars from some lines and added cars to other lines. We have put on many new cars, increasing the total number in operation."

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway for the month of March and six months ended March 31 compares as follows:

	1909.	1908.
March gross	$ 298,728	$ 288,674
Expenses	206,832	202,390
March net	$ 91,896	$ 86,284
Charges	33,901	33,119
March surplus	$ 55,995	$ 48,165
Six months gross	1,813,342	1,747,137
Expenses	1,166,384	1,145,866
Six months net	$ 646,958	$ 601,271
Charges	181,242	186,253
Six months surplus	$ 456,716	$ 415,018

KINGS COUNTY ELECTRIC.

The Kings County Electric Light and Power Company, including Edison Electric Illuminating Company of Brooklyn, reports combined earnings for the quarter ended March 31, 1909, as follows:

Gross	$938,492
Operating expenses, including general, technical, production and distribution expenses	432,464
Net over operating	$506,028
Replacement and depreciation	107,179
Balance	$398,849
Fixed charges	151,640
Surplus	$247,209
Quarterly dividend	200,000
Net surplus for quarter	$ 47,209

The Edison Electric Illuminating Company of Brooklyn reports for the month of March, 1909, compared as follows:

	March, 1909.	March, 1908.
Gross earnings	$289,298	$272,157
Expenses	143,674	133,646
Net earnings	145,623	$138,510
Depreciation	32,073	29,714
Balance	$113,549	$108,796
Fixed charges	50,546	50,546
Net surplus	$ 63,003	$ 58,249

ONEIDA RAILWAY.

The report of the Oneida Railway Company for the quarter ended December 31, 1908, compares as follows:

	1908.	1907.
Total railway operating revenue.	$83,930	$68,443
Total railway operating expenses.	56,911	46,823
Net railway operating revenue.	$27,013	$21,619
Net revenue from outside operations	229	1,000
Total net rev. from operation.	$27,248	$22,620
Taxes accrued	2,039	954
Operating income	25,209	21,666
Total deductions from gross income	3,742	100
Net operating income	$21,466	$21,566

CHICAGO RAILWAYS.

The annual report of the Chicago Railways Company, for the year ended Jan-

uary 31, 1909, compares, representing practically the first complete statement under the new arrangement, as follows:

	1909.	1908.
Total earnings	$11,037,071	$10,560,571
Total expenses	7,725,950	7,392,400
Balance, actual net	$ 3,311,121	$ 3,168,172
Balance, 30 per cent of gross	3,311,121	3,168,172
Interest on evaluation	1,739,684	1,566,159
Net income	$ 1,571,437	$ 1,602,013
Division of net:		
City Chicago, 55 per cent	864,290	881,107
Chicago Rys., 45 per cent	707,147	720,906
Value of property, January 31, 1908		32,589,047
Rehabilitation during year		6,418,306

LONDON UNDERGROUND.

The Underground Electric Railways of London report gross earnings for the week ended April 3, and thirteen weeks ended April 3, 1909, compared as follows:

Company:	1909.	1908.
Bakerloo	£ 3,370	£ 3,075
Piccadilly	5,880	5,685
Hampstead	3,810	3,210
District	9,863	9,211
Tramways	5,330	5,889
Total	£ 28,253	£ 27,070
Total, thirteen weeks	361,234	335,945

NORTHERN OHIO LIGHT AND TRACTION.

The report of the Northern Ohio Traction and Light Company for the month of March and three months ended March 31, compares as follows:

	1909.	1908.
March gross	$150,684	$129,659
Expenses	86,720	81,273
March net	$ 63,964	$ 48,386
Charges	43,803	43,953
March surplus	$ 20,161	$ 4,433
Three months gross	435,083	375,085
Expenses	251,971	241,631
Three months net	$183,112	$133,454
Charges	130,986	131,595
Three months surplus	$ 52,126	$ 1,859

CALUMET & SOUTH CHICAGO.

The annual report of the Calumet & South Chicago Railway Company for the year ended January 31, 1909, which is the first statement made since that corporation accepted its new franchise ordinance, shows gross receipts of $839,296, a loss of $35,720 compared with the fiscal year ended December 31, 1907.

The compared income and expense account for the year ended January 31, 1909, compared with the two preceding years ended December 31 follows:

Year ended:	Jan. 31, 1909.	Dec. 31, 1907.
Passenger earnings	$780,520	$835,922
Chartered cars	1,162	5,629
Miscellaneous earnings	57,114	33,465
Gross from operation	$839,296	$875,016
Maintenance of way and structures	36,613	50,094
Maintenance equipment	32,757	81,100
Conducting transportation	411,959	376,520
General expenses	97,581	98,789
Total expenses	$578,910	$606,512
Net from operation	260,386	268,504
Taxes	8,597	9,901
Net income	$251,789	$258,603

AURORA, ELGIN & CHICAGO.

The report of the Aurora, Elgin & Chicago Railroad Company for the month of March and nine months ended March 31 compares as follows:

	1909.	1908.
March gross	$ 101,972	$ 95,773
Expenses	60,350	56,652
March net	$ 41,622	$ 39,121
Charges	28,764	27,770
March surplus	$ 12,858	$ 11,351
Nine months gross	1,076,989	1,058,533
Expenses	589,257	584,131
Nine months net	$ 487,732	$ 474,402
Charges	251,692	250,649
Nine months surplus	$ 236,040	$ 223,753

MASSACHUSETTS ELECTRIC.

The Massachusetts Electric Companies' statement for the quarter and six months ended March 31, 1909, compares as follows:

January 1 to March 31:	1909.	1908.
Gross	$1,613,034	$1,552,171
Expenses	1,238,264	1,127,120
Net	$ 374,770	$ 425,051
Charges and taxes	450,698	464,316
Deficit	$ 75,928	$ 39,265
October 1 to March 31:		
Gross	3,385,789	3,332,246
Expenses	2,535,692	2,447,783
Net	$ 850,097	$ 884,463
Charges and taxes	887,592	900,752
Deficit	$ 37,495	$ 16,289

TRI-CITY RAILWAY AND LIGHT.

The Tri-City Railway and Light Company's report to the New York Stock Exchange for the three months ended March 31, 1909, shows as follows (includes subsidiary companies):

	1909.
Gross	$489,836
Expenses and taxes	282,950
Net	$206,886
Interest	113,089
Sinking fund	12,500
Surplus	$ 81,297
Preferred dividend	42,393
Three months surplus	$ 38,904

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of March and three months ended March 31 compares as follows:

	1909.	1908.
March gross	$ 541,936	$ 484,622
Expenses	279,307	252,824
March net	$ 262,629	$ 231,798
Charges, taxes and pfd. div.	138,963	123,386
March surplus	$ 123,666	$ 108,412
Three months gross	1,550,698	1,408,438
Expenses	838,916	764,668
Three months net	$ 711,782	$ 643,790
Charges, taxes and pfd. div.	406,889	368,130
Three months surplus	$ 304,893	$ 275,660

CANADIAN GENERAL ELECTRIC COMPANY.

Coincident with the annual report of the General Electric Company appears the statement covering operations last year of the Canadian General Electric Company, which was formerly controlled by the American corporation. Canadian minority interests in the smaller company exercised an option which they had on the majority of the stock, and two years ago considerable British money was interested in the property.

Last year the Canadian company showed profits of $753,088, comparing with $722,433 in the previous year and $853,675, record earnings of the banner electrical year—1906. The nine-year record of ten per cent annual dividends was broken in 1908 through the declaration of but nine per cent on the common stock.

For a series of years the profits and dividends paid have been as follows:

	Profits.	Dividends.
1908	$753,088	$439,042
1907	722,433	488,000
1906	853,675	484,690
1905	608,207	335,499
1904	582,519	284,890
1900	262,903	127,623
1897	138,404	71,330

GUANAJUATO POWER AND ELECTRIC.

The report of the Guanajuato Power and Electric Company for the year ended December 31, 1908, compares as follows:

	1908.	1907.
Gross	$463,974	$394,189
Expenses	110,761	88,758
Net	$353,214	$305,431
Interest and sinking fund	114,428	101,848
Surplus	$238,786	$203,582

Concerning the outlook for the future, President Hine says:

"The effect of the recent financial panic, which has been severely felt in Mexico during the past year, and the large drop in the price of silver have greatly retarded new developments. The fact that this condition has not resulted in any net loss of earnings, but, on the contrary, is a considerable net gain, is very encouraging. The large projects for new mining developments at Guanajuato, we believe, have been merely postponed. Good crops during the past year and improved financial conditions during the latter part of the year have resulted in a very noticeable improvement in our business in the districts outside of Guanajuato. We may expect, with considerable confidence, about the same rate of increase of earnings during the current year as during the past year, and a much more rapid increaso during the following year."

NORFOLK & PORTSMOUTH TRACTION.

The report of the Norfolk & Portsmouth Traction Company for the month of March and three months ended March 31 compares as follows:

	1909.	1908.
March gross	$156,394	$138,791
Expenses	93,720	88,060
March net	$ 62,674	$ 50,731
Three months gross	468,558	415,452
Expenses	269,744	274,961
Three months net	$198,814	$140,491

Omaha Electrical Exposition.

The second annual electrical show of the Omaha Electrical Exposition, Incorporated, was opened at the Auditorium, Omaha, Neb., by President Johnston on Thursday evening, May 6. It was estimated that fully 4,000 people visited the show on the opening night. At 7:17 p. m. a congratulatory wireless telegram was received from President Taft and a reply was immediately sent back to the White House. These two aerograms were read from the dimly-lighted stage by President Johnston, whereupon City Electrician Michaelsen, who was in charge of the electric installation of the show, threw the switch that transformed the place into a blaze of light and set the machinery in motion.

The decorative scheme of the show, which is to last for ten days, is brilliant and artistic. The characteristic colors of the illumination are red and white, although other color combinations are in evidence on the individual booths, the Nebraska Electric Company, for instance, having its three large booths tastefully outlined with arches of forty-watt tungstens with a color scheme of blue and white.

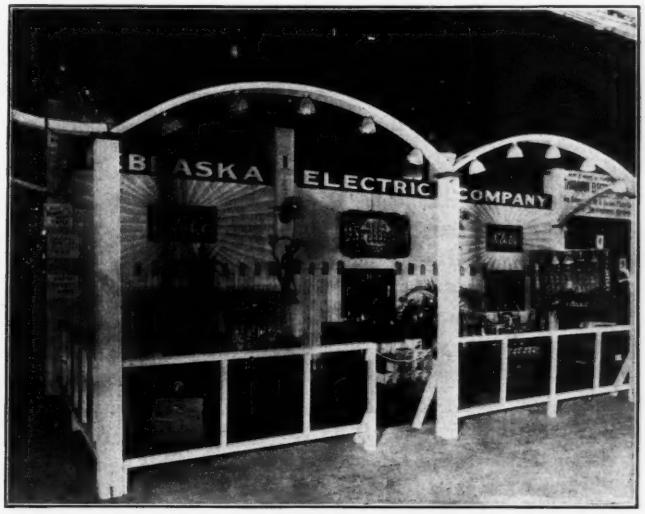
To add to the general picturesqueness of the show were sixteen great coronas suspended from the ceiling, laden with colored globes and revolving at various rates of speed. An immense sign in green lights was also in evidence, announcing the presence of the industrial power exhibit on the stage. This exhibit is described more fully below.

The wireless station, in charge of Sergeant Yurgensen and under the supervision of Lieutenant Ware, is operated and demonstrated by a detail of soldiers in khaki from the First Omaha Signal Corps. This consists of two sets of army instruments which can be hastily packed up in traveling boxes or erected in a hurry and capable of sending messages to a considerable distance. This exhibit attracted a great deal of attention and messages are constantly being sent and received during the show.

The industrial exhibits are of unusual interest and reflect greatly to the credit of Manager J. M. Gillan, who has been tireless in his efforts to make the show a success. Mr. Gillan's courteous treatment and assistance to exhibitors and visitors elicited great praise from all, and the unanimous opinion was that this year's show is a big improvement on that of last year. Some of the most attractive exhibits are described below.

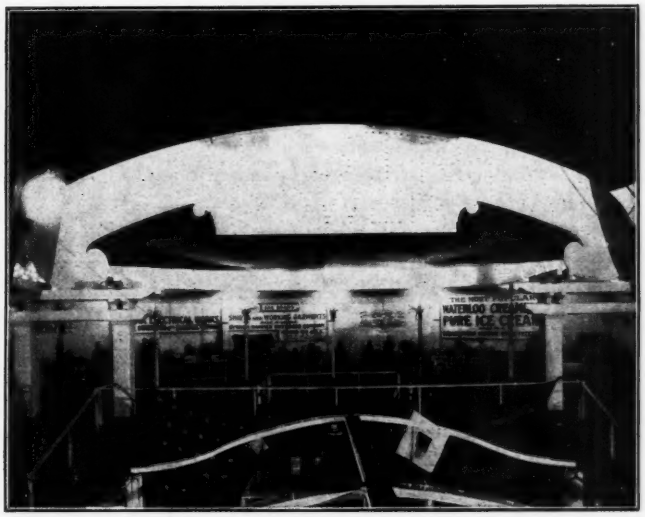
On the stage of the auditorium the Omaha Electric Light and Power Company has a semicircular row of eight

UNION PACIFIC ELECTRIC COMPANY.



NEBRASKA ELECTRIC COMPANY.

JOSEPH R. LEHMER.



OMAHA ELECTRIC LIGHT AND POWER COMPANY.

booths, in which different companies are giving practical demonstrations of electrically operated machinery and devices of various kinds. These include: Motors at work in a modern creamery, and ice-cream freezers, by the Waterloo Creamery Company; electroplating outfit, by the Omaha Plating Company; motor-driven dough-mixing machine, by the New England Bakery; manufacture of electrical machinery, by the Omaha Electric Works; motor-driven knife machine for cutting several thicknesses of cloth at once, by the Byrne-Hammer Dry Goods Company; shoe-repairing machinery, by the Rapid Shoe Repair Company; motor-driven machines for machine-shop work, by Peter Melchiors, of the Melchiors Machine Works; and last but not least, electrically-operated printing machinery by the Great Western Type Foundry. At this last-mentioned booth there is published daily a bright little newspaper, *The Daily Electric World,* which is one of the unique features of the show. The first number was off the press seven minutes after the receipt of President Taft's aerogram on the opening night. C. D. O'Kieffe is the printer-publisher.

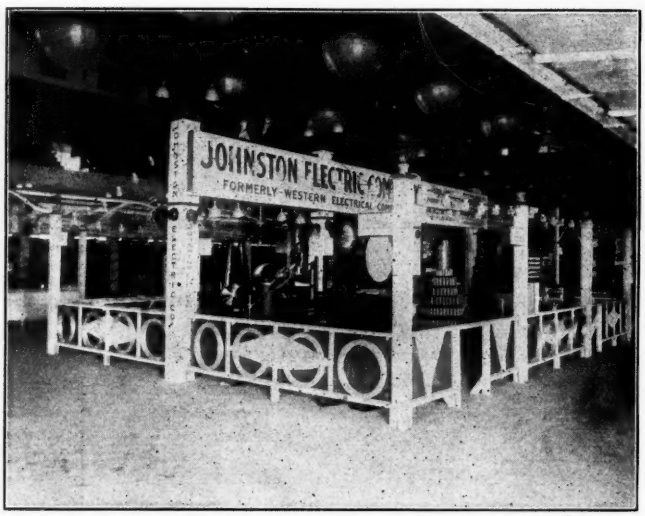
The varied nature of the above exhibit of the Omaha Electric Light and Power Company is causing a remarkable display of interest by the visiting public on the multifarious uses to which electricity may be applied, and no one after seeing these various and unique demonstrations can go away without getting some idea or suggestion as to the advantages of electric power for industrial purposes in practically any business whatsoever. J. B. Zimman, contract agent of the company, is in charge of this remarkable exhibition.

At the Union Pacific Railroad Company's booth Dr. Frederick Millener is attracting a great deal of attention with a miniature working railroad section, with dummy cars running over a piece of track. In conjunction with this are a semaphore station and a block-signal system in practical operation, which are ably demonstrated by Dr. Millener and his assistants. A wireless station has also been installed here and Dr. Millener has been delivering a series of popular lectures on wireless telegraphy and allied electrical subjects in such a way that even the merest tyro could not fail to understand. The genial doctor also gave some spectacular and instructive demonstrations with a specially designed transformer of his own construction and with a twenty-four-inch spark coil made in his own laboratory.

Joseph R. Lehmer of Omaha occupied five booths, very neatly illuminated by the use of tungsten lamps and Holophane reflectors, with one large electrical sign in red and white carrying out the color effect of the exposition in the center booth. Mr. Lehmer's exhibit was in charge of H. W. Neal, assisted by C. A. Fried, Glen Deyo, N. W. Nichols and S. M. Kempton. The chief features of this exhibit were the many instruments, apparatus, cooking devices, washing machines, sewing-machine motors, all in motion, and last but not least, the playing of "A Big Night Tonight" upon the bells by a sign flasher. The following companies made this collection of booths their headquarters: The Westinghouse Company, represented by W. R. Pinckard, S. G. Peticolas, J. M. Shilling, Cecil Woods and C. W. Regester; W. N. Matthews and Brother, by V. L. Crawford; Benjamin Electric Manufacturing Company, by H. E. Watson; Holophane Company, by Morgan Ellis; H. W. Johns-Manville Company, by George A. Saylor; Chicago Fuse Wire and Manufacturing Company, by A. S. Merrill; H. D. Sears, by C. L. Hight; I. A. Bennett Company, by W. C. Rardin.

One of the most prominent and largest exhibits was that of the Johnston Electric Company (formerly the Western Electrical Company) of Omaha, Neb., which occupied four booths. Among the most attractive features of this exhibit were a large X-ray machine and an electrical optical illusion, operated by means of a flasher made by the Electro-Ad Company of Detroit. An instructive demonstration of the current consumption of various types of incandescent lamps was also made. Following are some of the lines of manufactures represented in this exhibit: Jandus Electric Company, fans; Indiana Steel and Wire Company, telephone wire; Briner-Poge Company, fuses and blocks; Sprague Electric Company, flexible conduits; W. Douglas Wooley, non-gap lightning arresters; Hallett Iron Works, pole hardware and specialties; Crescent Insulated Wire Company, wires and cables; Blake Signal and Manufacturing Company, insulated staples and specialties; the Automatic Electric Washing Machine Company, electric washing machines, demonstrated by H. E. Kennedy.

The Johnston Electric Company was represented by President G. W. Johnston, F. G. Balz, M. N. Murphy, P. P. Hinckley, F. Lowry, W. C. O'Connell and A. G. Henning, who was in charge of the exhibit.



JOHNSTON ELECTRIC COMPANY.

A most attractive exhibit was that of the Nebraska Electric Company, which occupied three large booths, as mentioned above. This company showed a very attractive display of Simplex electric-heating devices which were demonstrated by one of the company's representatives. The complete electric range with its cooking utensils was an object of considerable interest to the ladies who patronized the show. A large and varied assortment of Robbins and Myers fans, Columbia batteries, Buckeye and Brilliant lamps, Chicago Fuse Wire and Manufacturing Company's outlet boxes, enclosed National Code fuses and cut-outs, Monarch Weatherproof wire and Simplex rubber-covered wire were also shown. Those in charge of this exhibit were A. G. Munro, W. W. Fraunkfurt and J. F. Munro.

The I. A. Bennett Company of Chi-

cago, agents for the National Metal Molding Company and Steel City Electric Company, was represented by Walter C. Bardin, who effectively extolled the virtues of Economy enameled rigid conduit, Flexduct flexible conduit (soapstoned), National metal molding, and the new rustproof rigid iron conduit Sherarduct, Star bushings, Fullman lock nuts and floor boxes.

A unique experience was afforded to visitors at the show of seeing chickens hatched by an electric incubator which was installed by City Electrician Michaelsen. This device has a glass top and the heat is furnished by electric lights. There is a thermostat in it, so that as soon as the heat becomes excessive the lights in the incubator are shut off automatically and only the light above is left, but this reveals clearly the process of hatching. The eggs were placed in the incubator three weeks before the opening so that hatching would take place during the show.

An attractive display of various types of the Brilliant Electric Company's incandescent lamps was made by this company in connection with the Nebraska Electric Company of Omaha. Frank B. Galloway, field manager of the Brilliant Company, was in charge of this display.

Weber sockets and specialties were shown in several booths. Chauncey L. Hight, representing Henry D. Sears, general sales agent for the Weber products, was in attendance looking after the interests of the Weber Electric Company.

Among other special representatives present at the show were George Loring, sales manager, and Howard F. Viot, of the Shelby Electric Company, Shelby, Ohio; A. M. Miltenberg of Omaha, local manager of the Nernst Lamp Company; L. E. Sperry, manager, Western Electric Company, Omaha; H. J. Moss, secretary and treasurer, Harwood Electric Heating Company, Hutchinson, Kan.; Joseph Thomas, Capital Electric Company, Denver, Colo.; William S. Reid, General Electric Company, Chicago; George H. Porter, Western Electric Company, Chicago; Cameron MacIntyre, Illinois Electric Company, Chicago; F. E. Foote, Elmo Electric Washers Company, Grinnell, Iowa; A. E. Blood, General Compressed Air and Vacuum Machinery Company, St. Louis, Mo.; M. A. Gurney, Iowa and Nebraska representative of the Tungstolier Company, Cleveland, Ohio.

A notice of the Omaha show would be incomplete without some mention of the "added attractions." Music was furnished by Green's Band, and Miss Blanche B. Mehaffey was repeatedly encored for her pleasing solos. A fine musical programme has been provided for each day of the show and this is not the least of the many attractions. Refreshment booths are also much in evidence, at which commendable service is being given by the ladies of the Kountze Memorial Church of Omaha. There are also many other booths of a similar nature.

A good idea of the general arrangement of the show can be obtained from the accompanying photographs.

Among the exhibitors not specifically mentioned above are the following: Alamo Engine Company; American Electric Heater Company; American Steel and Wire Company; V. D. Anderson and Company; Antique Mosaic Shade Company; M. B. Austin and Company; James G. Bradley Electric Company; Bradley Hubbard Manufacturing Company; David J. Braun Manufacturing Company; Burgess-Granden Company; Bryant Electric Manufacturing Company; Capital Electric Company; Chicago Fuse Wire and Manufacturing Company; Crescent Insulated Wire and Cable Company; Copygraph Company; Crocker-Wheeler Company; Crouse-Hinds Company; Crane Company; Chicago Fuse Wire Manufacturing Company; James Corr Electric Company; Duntley Manufacturing Company; Damon Electric Company; Electric Suction Sweeper Company; Emerson Electric Manufacturing Company; Excello Arc Lamp Company; Fairbanks-Morse Company; *Electrical World;* ELECTRICAL REVIEW AND WESTERN ELECTRICIAN; Fostoria Incandescent Lamp Company; Fostoria Glass Specialty Company; Fort Wayne Electric Works; Gillender Sons; Gill and Company; Hallett Iron Works; Haskins Glass Company; Handel Company; Ilg Electric Ventilating Company; Ide and Sons; Indiana Steel and Wire Company; Johns-Manville and Company; Kimball Brothers Company; Kinetic Engineering Company; Lovett and Company; George H. Lee Company; A. Leshen and Sons Rope Company; Lane and Bodley Company; M. Klein and Son; Mechanical Appliance Company; Edward Miller and Company; Morrean Gas Fixture Manufacturing Company; National Carbon Company; Nebraska Cycle Company; 1900 Washer Company; D. L. Neuhauser; Nungessor Electric Battery Company; Nuniaticon Company; Omaha Electrical Works; Piano Player Company; Phœnix Glass Company; P.-R. Electric Manufacturing Company; Perkins Electric Switch Manufacturing Company; *Popular Electricity;* O. Patten Manufacturing Company; John A. Roebling's Sons Company; Richard Electric Company; Singer Sewing Machine Company; Sunderland Roofing and Supply Company; Smith-Premier Typewriter Company; R. F. Struthers; Sikes and Company; Safety Armorite Conduit Company; Standard Electric Company; Thompson Brothers; Taber Pump Company; United States Government Exhibit; United States Incorporated Lamp Company; Westinghouse Electric and Manufacturing Company; Westinghouse Machine Company; Williams and Company; Wagner Electric Company; Woolley Electric Company.

Block Signal Mileage.

Washington.—The report of block-signal mileage on the railroads of the United States January 1, 1909, has been issued by the Interstate Commerce Commission. The report was compiled by the Block Signal and Train Control Board from figures furnished by the railroad companies in compliance with an order of the commission issued November 4, 1908.

The total length of road operated under the block system on January 1, 1909, was 59,548.7 miles, being a net increase since January 1, 1908, of 870 miles. The manual block mileage has decreased 517.6 miles during the year, while the automatic block mileage has increased 1,387.6 miles.

The financial depression of the past year and a half undoubtedly is accountable for the comparatively small increase in the mileage reported. Many roads which contemplated installing the block system in 1908 deferred it, while other roads on which the system was in use discontinued it entirely.

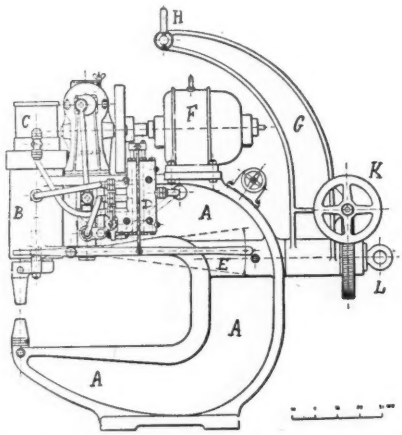
The report indicates that many roads are rapidly substituting the telephone for the telegraph in the operation of the block system. There was an increase of 2,357.2 miles of road (3,055.2 miles of track) operated by means of the telephone during the year.

Permissive blocking is allowed under four general conditions, namely: (1) a freight train following a freight train; (2) a passenger train following a freight train; (3) a freight train following a passenger train, and (4) a passenger train following a passenger train. A majority of the roads maintain an absolute block for passenger trains, while nearly all of them allow permissive movements for freight trains.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

HYDROELECTRIC RIVETER OF THE OERLIKON COMPANY.

In order to obtain a perfect rivet—that is, well-formed heads with bodies completely filling the holes—the rivets must be subjected to the maximum pressure for a certain time, and the organs transmitting the pressure must not vibrate. Three methods have so far been principally employed for the operation of portable riveters—the hydraulic, pneumatic and electric methods. The hydraulic method fulfills the above conditions perfectly, but requires a number of expensive accessories. On account of the compressibility of air it is impossible to obtain a steady pressure by the pneumatic method. The electrical method as employed so far does not



ELEVATION OF OERLIKON HYDROELECTRIC RIVETER.

give any better results, as the duration of the final maximum pressure cannot be regulated at will. In fact, the energy accumulated in the mass forming the flywheel is expended in much less time than the rivet takes to cool. But the electric riveter has the advantage of not requiring any extensive piping or expensive accessories and of being easily transportable, since it can be put in operation by merely connecting it to the nearest electric circuit. The Oerlikon Company has combined the advantages of the hydraulic riveter as regards perfection of the work, and of the electric riveter as regards convenience of operation. This has been accomplished by equipping the riveter with an electric motor driving a pressure pump and a reservoir containing the fluid, all mounted on top of the machine. The entire outfit weighs 1,250 kilogrammes and is capable of developing a pressure of forty tons at the movable jaws. The first riveter of this kind has been in operation for over six months. By its use three men have been able to fasten 1,000 rivets of twenty millimetres in ten hours, while formerly five men were necessary to fasten 500 rivets in the same time.—*Translated and abstracted from La Revue Electrique (Paris), April 15.*

ELECTROMAGNETIC DRILLS.

The improvement of the electromagnetic drill introduced by S. & E. Fein, of Stuttgart, consists of two electromagnets arranged alongside of the drill spindle, by means of which it can be attached to the working object without such accessories as clamps, etc. The drills may be employed to advantage in place of the already extensively used electrically operated hand drills, in all cases where their fastening is inconvenient or even impossible. They may be used for drilling, widening and deepening holes, as well as for milling and cutting threads. A special arrangement at the spindle permits a quick and exact centering of the tool. The machine consists essentially of three parts—the electric motor, the drilling machine proper with the special centering arrangement, and the attaching electromagnets. The motor shaft is connected to the drill spindle by means of angle gearing, the spindle being axially movable for the purpose of quick and exact centering. The electromagnets are attached to a bow, and the machine can be turned on a plate and fastened in any position. This arrangement and the spindle adjustment make it possible to work with the machine in very limited spaces.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), April 10.*

PROFESSOR MAJORANA'S SYSTEM OF WIRELESS TELEPHONY.

A great difficulty in establishing wireless-telephone communication at long distances is the limited current intensity and pressure which ordinary microphones can withstand. Professor Majorana, of Rome, has obtained excellent results with an instrument based on the electro-capillary phenomena investigated by Lippmann and others. It consists, in principle, of a vibrating diaphragm to which a small glass tube is fixed, through which slightly acidulated water flows under steady pressure. Upon leaving the tube the liquid passes over a commutator composed of two platinum sheets and forms a thin film, which establishes electrical connection between them. The sheets are connected to a battery, and the current furnished by the same depends on the resistance of the liquid film, which may be varied by regulating the rapidity of the flow. The vibrations of the diaphragm also modify the speed of the flow and produce alterations in the resistance of the electrodes and consequently variations in the corresponding currents, which thus faithfully reproduce the sound vibrations that influenced the diaphragm. This device is capable of withstanding relatively heavy currents, and good results have been attained by its means, perfect wireless-telephone communication having been established at a distance of 500 kilometres. The other apparatus employed does not present any particular novelty. The Poulsen arc is used under a direct-current pressure of 500 volts, and the antennæ are excited by a Tesla transformer. The receiving antenna acts inductively on an oscillatory circuit, consisting of the secondary of a transformer and a condenser, to the terminals of which the detector is connected. The latter comprises simply a thermo-electric detector and a telephone.—*Translated and abstracted from L'Industrie Electrique (Paris), April 25.*

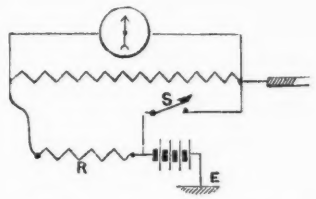
SILUNDUM, A NEW PRODUCT OF THE ELECTRIC FURNACE.

Experiments were carried on for a number of years by F. Boelling with the object of utilizing silicon carbide for electrical resistances by combining it with various binding materials, but with unsatisfactory results. Researches in another direction led to the development of a process by which carbon, coke or charcoal pieces of any shape, as rods, tubes, crucibles, etc., are transformed into silicon carbide. A resistance material for high temperatures, up to 1,700 degrees

centigrade, is thus obtained, which is not a conductor of the second class, does not oxidize in the air, and is not attacked by acids at ordinary temperatures. Silicon carbide, better known as carborundum, was so far known only in the amorphous and crystalline states, and it was assumed that it is formed by the sublimation of carbon and silicon at high temperatures. The author found that silicon vapors penetrate into carbon, when both are at a very high temperature. Silicon exists only in the liquid form at the temperature (1,800 to 1,900 degrees) at which the process takes place, while carbon still remains unchanged, provided that no air is admitted. Silundum, as the new material has been named, is therefore a product obtained when carbon is fused in silicon vapor at a high temperature. Electrical furnaces of the kind employed in the production of carborundum are used for the manufacture of this substance. The carbon pieces to be transformed into silundum or to be provided with a coating of silundum are placed in amorphous carborundum or in a mixture of carbon and sand and then heated by the electric current. In the former case some sand may be added in order to obtain the necessary silicon more easily. The transformation of the pieces into silundum depends on the time, the temperature employed, and the volume of the pieces. They can be transformed either entirely or provided with a coat of silundum of any desired thickness. The transformation takes place the more easily the more porous the material employed, and therefore coke and charcoal are readily changed into silundum. The material is capable of withstanding very high temperatures, and is therefore excellently suited for electrical heating and cooking apparatus, the manufacture of electrical resistances and for many other similar purposes. A rod 800 millimetres in length and six millimetres in diameter can carry permanently a current load of four kilowatts and intermittently a load of eight kilowatts. Filaments for incandescent electric lamps were also prepared of silundum, as an experiment, but a brown deposit formed on the glass after they were in use for but a short while, so that the material is evidently not suitable for this purpose. Silundum is at present manufactured by the Prometheus Electrochemical Company, whose works are located in the city of Frankfort-on-the-Main, in Prussia.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), April 22.*

THE D'ARSONVAL GALVANOMETER.

When testing short lengths of highly insulated wire with a D'Arsonval galvanometer of about 1,000 ohms, and a universal shunt of 10,000 ohms set for a multiplying power of 1, in order to obtain the greatest sensitiveness, the movement of the coil is extremely sluggish if the short-circuit key be closed during the



CONNECTION FOR TESTING INSULATION.

test for the purpose of checking the instrument zero. Also it will be noticed that on opening the key before the battery is applied, there is a small deflection, although no charge may be in the cable core under test. Both these troubles are due to the alteration of the permanent shunting of the galvanometer when the short-circuit key is opened or closed, the shunt being 10,000 ohms with key open and practically a short-circuit across the coil with key closed. The writer, in a letter published in the *Electrical Review* about nine years ago, outlined a simple method of eliminating both these disadvantages, but as the letter was very brief, it is thought that a fuller explanation may be of interest.

The accompanying diagram represents the usual connections for testing insulation, with shunt value 1, the only alteration being the insertion of a high resistance (100,000 ohms is convenient) at R, between battery and traveling connection. Inserting a resistance in the galvanometer circuit, as is sometimes done, decreases the sensitiveness of the instrument considerably, but this arrangement does not affect it. With key S open, the shunt is 10,000 ohms; with S closed, it is the resistance in parallel of 10,000 ohms and 100,000 ohms—a very small change of shunt and consequent damping. Both the disadvantages mentioned above are completely eliminated by this device, and it has also, incidentally, the virtue of damping disturbances due to a faulty battery or earth currents, and lessening the shock to the galvanometer (and perhaps some unwary person) should the free end of the cable core be accidentally earthed during a test.

This resistance is not required when capacity is being measured, as S remains open throughout the test, and it should always be removed unless the capacity is very small. For determining the constant of the galvanometer R may either be cut out or added to the resistance in circuit. It is not necessary to use it when the multiplying power of the universal shunt is greater than about 5, as then the shunting of the galvanometer changes little with the short-circuiting at S. For long sections of submarine cable R may be considerably reduced, or removed altogether. It will be noticed, however, that the battery is connected directly to the cable as long as S is closed, so that the resistance R is not in the circuit in an insulation test until about thirty seconds after the battery is applied, as the galvanometer is usually kept closed for that length of time before the deflection is observed. It will be found that the insertion of this high resistance in the way described does not affect the electrification of the cable core in any case where, owing to the low multiplying power of shunt, the galvanometer would be improved by using it.—*Abstracted from The Electrical Review (London), April 16.*

ELECTRICALLY-DRIVEN ROLLING MILLS.

In view of the intense interest recently aroused by the new steel mills at Gary, Ind., a brief description of an electrically-driven reversing steel rolling mill recently installed at the works of Sir Alfred Hickman, at Bilston, England, will be of value. There are now in operation a thirty-six-inch cogging mill and a twenty-four-inch finishing mill. As at Gary the driving power is furnished by electrical motors, the current for which is supplied by generators driven by gas engines working on blast-furnace gas. The generator current is supplied to a flywheel load equalizer consisting of a motor mounted on a common shaft with two cast-steel flywheels, each weighing thirty-two tons and running at 300 revolutions per minute. Mounted on this shaft are two generators, one actuating an electric motor which drives the cogging mill, and the other a motor driving the finishing mill. Although the engine power is only about 1,000 horsepower the reserve energy of the flywheels enables a power of 12,000 horsepower to be developed for short periods when necessary. Reversing is accomplished by simply moving over a lever, and takes about six seconds from full speed in one direction to full speed in the reverse direction.—*Abstracted from The Electrical Magazine (London), April 15.*

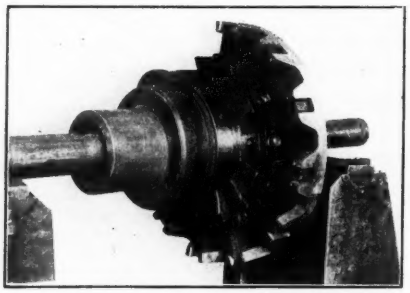
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A New Type of Electric Locomotive.

The accompanying illustrations show a novel type of electric locomotive which has been designed jointly by the General Electric and American Locomotive companies for trying out a scheme of transmitting power from the motors to the drivers through side-rods instead of by the ordinary methods.

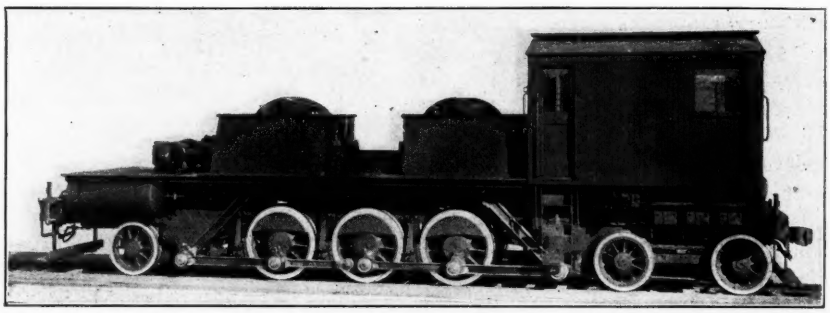
The locomotive is designed for a tractive effort of 30,000 pounds at a speed of eighteen miles per hour, with a maximum speed of fifty miles per hour, and will operate equally well in either direction. It has been tried out with temporary motors of a somewhat smaller capacity and the tests have demonstrated conclusively that the design is entirely satisfactory in every way. It is proposed to extend the cab over the entire length of the machine when the proper motors are installed on the locomotive. The present cab and guards are only for the temporary protection of the apparatus now installed.



FLEXIBLE COUPLING, PARTLY ASSEMBLED.

One of the principal advantages found in this type of construction is that a motor of large diameter and small air gap can be used in conjunction with small diameter driving wheels, and at the same time the motor can be spring-supported. The same motor equipment can also be used on locomotives with different diameters of driving wheels, thus permitting the interchange of equipment on freight and passenger locomotives. This type of locomotive is as well adapted for operation with direct-current motors as with those of the alternating-current type.

The electrical control is arranged in such a manner that the motors start as repulsion motors with short-circuited armatures and are changed over to series-repulsion motors for the higher speeds. This arrangement eliminates running with a short-circuited armature on high voltage and at the same time gives a high torque at starting.



EXPERIMENTAL SIDE-ROD ELECTRIC LOCOMOTIVE.

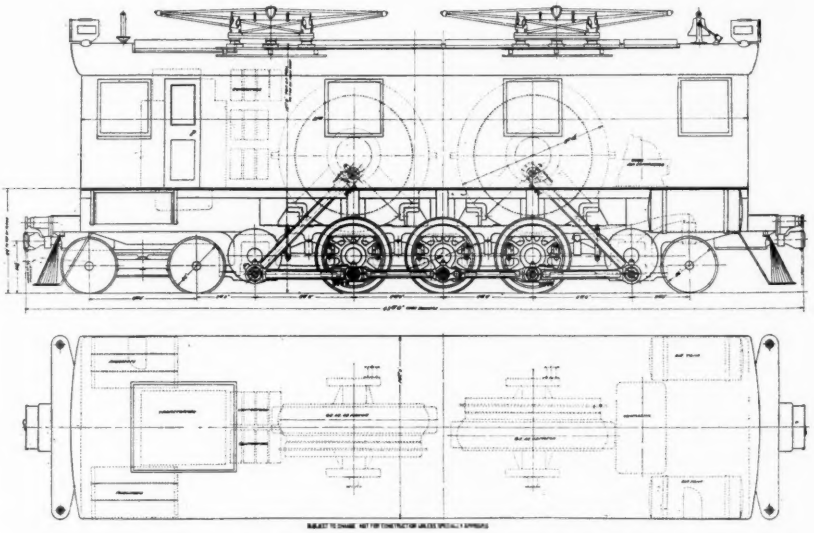
The armatures are similar to those of an ordinary direct-current machine with equalizer rings. They have multiple drum windings with the bars soldered directly into the commutator segments.

The field or stationary windings are of the distributed type and are made in two sections, the exciting and the inducing windings. The former has the same function as the field winding in an ordinary series motor, while the inducing winding introduces the working torque when the motor is connected as a repulsion motor.

All parts of the running gear, such as wheels, driving boxes, axles, springs, spring rigging, trucks, etc., follow standard steam locomotive practice.

Counterweights are used on the driving wheels to balance the side-rods, and it should be noticed that there are no reciprocating parts and therefore a perfect balance can be obtained.

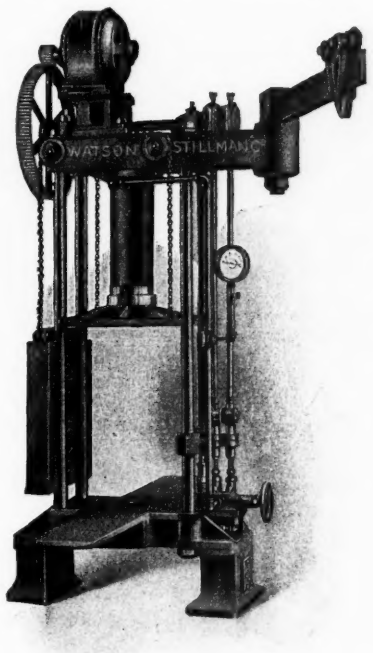
An interesting mechanical feature is the flexible coupling inserted between the armature shaft of the motor and the motor crank. This consists of a series of leaf springs arranged radially around the motor shaft and of such a strength as to carry the entire torque of the motor with an amount of deflection which will reduce the effect of the pulsating torque of a single-phase alternating-current motor to a minimum. The accompanying plan and elevation show the general arrangement.



PLAN AND ELEVATION OF ELECTRIC LOCOMOTIVE.

A New Reversed Cylinder Press.

The Watson-Stillman Company, 50 Church Street, New York city, has introduced a new reversed cylinder forcing press, which should prove a handy tool for pressing bearings and for miscellaneous work. As will be seen from the illustration, a crane bracket and beam extending from one end enables the operator to swing a heavy piece of work onto bracket shelves extending out from each side of the bottom platen. These shelves, thirty inches long by twelve inches wide, are detachable, can be lifted off on jobs where they would be in the way, and are sufficiently strong



THE WATSON-STILLMAN REVERSED-CYLINDER PRESS.

to support any work that will go into the machine. They will be appreciated by those who have had to push castings or parts into place on the ordinary small platen.

The motor, mounted upon pedestals on top of the press, drives the pump shaft through single-reduction gearing. A hand or belted drive is furnished, if desired, instead of the motor. On the other end of the pump shaft are two eccentrics, each driving one of the pistons of a three-fourths-inch by two-inch twin pump, for which the pedestal legs act as reservoirs.

The operating valve is of the single-screw stem type, and connected to release the pressure from the work when opened, and start the ram down when closed. It will not retain the pressure unless the motor is stopped or the liquid driven through the safety valve. Other types of valves may be substituted to meet special conditions. A gauge is furnished to read in tons or pounds per square inch, as desired.

New Electrical Heating Devices.

A new six-pound electric flatiron, manufactured by the American Electrical Heater Company of Detroit, Mich., is illustrated here. It has been sold by this company since the first of the year and seems to have the proper qualities for a highly efficient and satisfactory laundry iron.

The problem which has been difficult of solution in regard to electric irons has been to obtain a resistance medium for a heating element which will be durable and which may be well adapted for a construction whereby the heat is conducted with the minimum loss to the ironing surface where it is needed. There seems to be a mistaken idea which is very

ELECTRICALLY-HEATED FLATIRON.

prevalent that some substance may be found for a heating element which will give off more heat with a lower consumption of electrical current. This is impossible and contrary to the laws of nature, as a given number of watts will produce a certain number of heat units, no matter whether the resistance medium be copper, carbon, or anything else. The question of efficiency in electric-heating devices is entirely one of construction. That is to say, certain metals and substances are better adapted as resistance mediums for heating elements because they may be contained in the space provided by a flatiron or other heating device, and of course durability is essential, but the question of efficiency is governed entirely by a construction whereby all the heat units are conducted into the ironing surface in an iron, or the working part of any other heating device.

This new "Superior" iron, as it is called, is designed to solve this problem by having a heating element of peculiar construction. Heat is generated by a flat element, practically a solid mass of metal covering the entire bottom plate of the iron, in fact being a portion of it. Thus economy of heat units and distribution are obtained, and the iron is claimed to have an even heat in the point, sides, middle and heel.

The company reports a gratifying sale of the "Superior" iron, which has met with exceptional favor throughout this country, Canada and Mexico.

Another new article being introduced by the company is the new style coffee percolator. There has been difficulty in getting a thoroughly satisfactory percolator, heated either by alcohol or electricity. The difficulty has not been one of obtaining heat, but of properly percolating water through the ground coffee and obtaining the beverage free from tannic acid, clear and perfect in every respect. The percolator shown here is the well-known "Universal" percolator, which is generally recognized by the trade as the most satisfactory and efficient made either in this country or abroad. The "American Universal" coffee percolator does not boil the coffee, but starts to percolate inside of a minute after the current has been turned on, and by the time the liquid is at the boiling point, which will require something in the neighborhood of ten minutes, the coffee is ready to serve, and provided a fairly good grade of ground coffee is used, ideal results are obtained.

ELECTRICALLY-HEATED COFFEE PERCOLATOR.

Another new device is the new disk heater shown herewith. Its uses are well known, and nearly everyone who obtains an article of this kind finds himself unable to get along without it, as it may be used in a hundred and one ways around the house for such purposes as frying eggs or chops, boiling water and for innumerable other purposes. This heater is new in design and is provided with the well-known "Steel Clad" element, which is efficient and durable and instantly replaceable. It is finished with polished nickel with ebonoid handles and heat-insulated legs, which prevent the device from scorching or scratching a polished surface.

ELECTRICALLY-HEATED DISK STOVE.

Any of these devices may be attached to the ordinary lamp socket.

Important Developments in Bituminous Gas Producers.

For a number of years the Westinghouse Machine Company has been engaged in the development of a satisfactory form of producer suitable for gasifying the usual grades of bituminous fuels. The unusual difficulties encountered in the utilization of this kind of fuel have resulted in the trying out of many different types, both of the producer itself and of the necessary auxiliaries for producing clean gas. For the past year and a half the company has been engaged in trying out, upon a commercial scale, a producer plant which is now upon the market. These tests have been conducted with a full-sized equipment of 175 horsepower, including a standard gas engine of about the same power, by means of which the actual power value of the gas produced and the overall efficiency obtainable were determined.

These above-mentioned tests were brought to a conclusion on April 3, by drawing the fire in the producer, after it had been in continuous operation on various loads and on various fuels for a year past, these twelve months having been devoted to tests of one to four weeks' duration, both ten and twenty-four hours per day on standard fuels available for power purposes. These fuels included Pittsburg slack and run-of-mine, lignites from northern Colorado, Texas and South America; also peat and other fuels from various parts of the country. During most of the tests the load on the equipment was maintained at full rating, although one special test of one month and a half duration was made to determine accurately the standby loss of the producer standing idle.

The drawing of this fire, after one year's operation, was made the occasion of a demonstration of the producer plant before government officials and engineers from various parts of the country especially interested in bituminous-gas practice.

The fire was drawn without trouble or interruption, as large clinker formations were entirely absent, although the producer had, just previous to this occasion, been running on a full-load test for one month, using Pittsburg coal. The lining of the producer was found to be practically intact and in quite good enough condition for continued operation.

A detailed examination of the piping leading from the producer house to the engine on test showed that during this period of operation there had been no deposits of tar or lampblack.

The most important feature of the demonstration was the entire absence of tar formed in the producer gas. A similar examination of the mixing and inlet valves of the engine which has been used for the past year on this test showed practically no deposits of tar or lampblack such as would interfere with the operation of the engine. The Westinghouse plant uses no tar extractors, simply a static washer of small size in the place of the usual bulky coke scrubber. A rotary exhauster draws the gas from the fuel bed and delivers it to the engine at a definite pressure.

No gas holder is used in this process, as the producer regulation is entirely automatic. The gas produced has a moderate heat value, suitable for high compressions in the gas engine, and is uniform and clean, average samples showing not more than 0.02 to 0.03 grain per cubic foot of impurities.

The ash is fairly clean, and analysis of samples from time to time shows that not more than one per cent to three per cent of the combustible in the coal escapes in the ash.

The various fuels which have been used in this producer on test have been gasified successfully and have run as high as thirty-four per cent moisture, thirty-five per cent volatile, fifteen per cent ash and one-and-one-half per cent sulphur. The results of the tests show that with coal, such as Pittsburg slack or run-of-mine, an overall economy of 1.1 pounds per brake-horsepower-hour can be secured, equivalent to a little over nine-tenths pound per indicated-horsepower-hour. Moreover, the producer efficiency does not vary more than ten per cent from full load on the plant to no load.

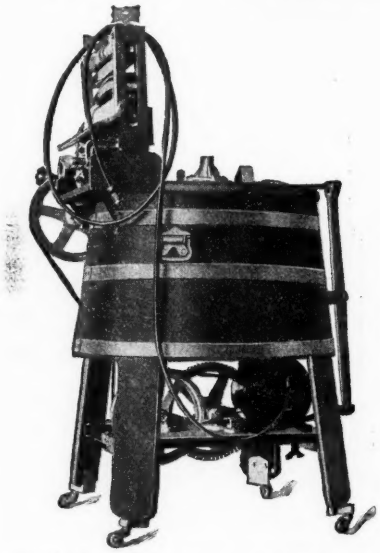
The results of this past year's tests have fully convinced the builders that the apparatus experimented with possesses unusual commercial value, and preparations are being made for extensive manufacture. A plant of this type has been in operation for over six months on Colorado lignite coal with equal success, as evidenced by an order recently placed with the Westinghouse Machine Company for duplicate equipment.

Automatic Electric Washing Machine.

The accompanying illustration gives a good idea of the electric washing machine manufactured by the Automatic Electric Washer Company, of Newton, Ia. The washing machine and wringer form a self-contained apparatus, the design and construction being carried out by skilled mechanics, making up a substantial and compact domestic apparatus.

The tubs are made of kiln-dried Louisiana cypress and the "Anchor" wringer has enclosed cogs and is fitted with ball-bearings. All of the gearing is fitted snugly so as to eliminate noise.

Emerson motors are used, one-sixth horsepower for direct-current and one-eighth horsepower for automatic start, single-phase, induction motors. The motor is fitted to a sheave mounted upon a five-eighths-inch shaft. Connected with the wheel is a loose collar carrying a small pinion. This pinion meshes with a large gear wheel, which is attached through a pitman to the driving mechanism. The movement is transmitted to the small pinion by a sliding clutch revolving with the shaft and shifted by a side lever. The movement of the lever to a vertical position releases the clutch and the motor runs light. A forward shift of the lever toward the wringer closes the clutch to engage the small sheave driving the wringer belt.

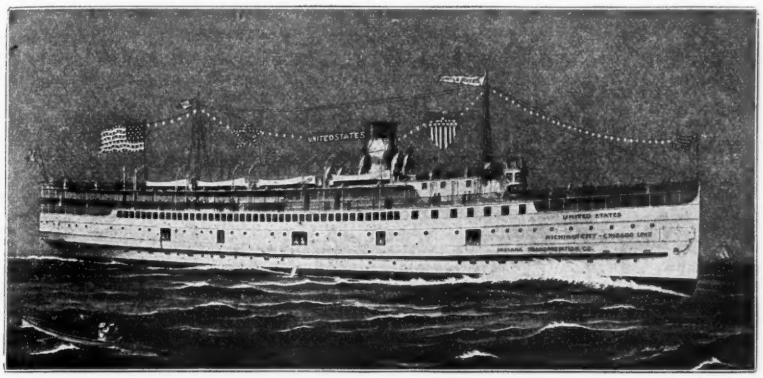


AUTOMATIC ELECTRIC WASHING MACHINE.

All of the working portions are mounted on a separate platform beneath the tub, placing the motor safely away from drippings. The entire machine weighs 160 pounds, crated, and is provided with casters for easy moving. Current may be taken by means of a flexible cord from an incandescent-lamp socket, and the manufacturers state that at ordinary central-station rates it costs on an average about two cents an hour to operate this machine.

New Lake Steamer Brilliantly Lighted.

Chief among the novel and interesting features of the new steel lake and ocean steamer United States, which goes into commission this month on Lake Michigan, is its electrical equipment. Residents along the lake shore will be afforded a sight this summer as this new vessel proceeds along its way. In addition to the regular lighting, it bears an immense shield decorated with red, white and blue lamps; a large skeleton star outlined with electric lights and a huge double-face electric sign reading "United States." This sign will flash the name of the vessel first on one side and then on the other. The crowning feature of this illumination is a national flag erected on the stern. It is constructed entirely of metal and is studded with red, white and blue electric lights, which are arranged with a flasher, giving the effect of a waving flag. The flag, star, name-sign and shield are connected with festoons in the three colors extending from the masts. All of the electrical features were manufactured in the shops of the Federal Electric Company, Chicago.



ELECTRICALLY ILLUMINATED LAKE STEAMER.

Other attractions of this new steamer are forty-six staterooms, each bearing the name of one of the States of the Union; specially planned panels between the staterooms, which display the portraits of the present governors of the States; a gigantic wooden map of the United States, made up of blocks of wood gathered one from each of the States of the Union, kiln-dried, and then highly polished to show their natural grain. Each block is carved in the exact geographical shape of the state from which it comes, so that when put together they form a complete map of the nation. The walls of the cabin are filled with oil paintings portraying the most striking events of our sea history.

The United States is 215 feet in length, forty feet beam, and to the top of the bridge measures fifty-six feet, and is equipped with a complete wireless-telegraph apparatus.

Arc Lamp with Disk Carbons.

A radical departure from the ordinary practice is the arc lamp invented by Legge & Scott, 82 West Nile Street, Glasgow, Scotland.

The chief novelty of this lamp lies in the fact that the carbon rods of the standard patterns of arc lamps are replaced by carbon disks which are inclined to each other so as not to obstruct the light. These disks are simultaneously rotated together by an ingenious but simple mechanism so that the periphery of each is burnt away uniformly. The arc is struck by separating the disks and the extent of movement is in nowise dependent on the size of the disks. All parts are rotative instead of sliding, as is the case in the usual types, and the mechanism is protected from injury by the fumes, inasmuch as it is completely separated from the arc by a baseplate. Stability of the arc is secured by a magnetic field, and it is claimed that the arc always remains in one position.

The lamp can be modified so as to be used as a flame, enclosed, or open type, by employing suitable carbons.

One great advantage of this new type of lamp is the very short over-all dimension, this being but twenty inches for the model ten-ampere experimental lamp which is being tried out. Another point to be noted is that the light will probably be stronger in the direction longitudinally midway between the planes of the carbons than in a direction at right angles, which would be an obvious advantage in street lighting.

There are many innovations promised in the new lamp other than those noted above, and its future progress will be noted with interest.

High-Voltage Tantalum Lamps.

Siemens Brothers' Dynamo Works, Tyssen Street, Dalston, London, announce that they are now able to supply tantalum lamps for voltages between 200 and 250 volts in thirty-two and fifty-candlepower sizes. In general appearance these lamps (one of which is illustrated) very closely resemble tantalum lamps of lower voltage except that they contain two filaments, each wound on a separate supporting arm, instead of one filament only. They possess, it is claimed, all the advantages such as mechanical strength, long life and suitability for burning at any angle, which have hitherto distinguished tantalum lamps.

200-250-VOLT TANTALUM LAMP (HALF SIZE).

Lighted Signs in Subway Cars.

The Hudson & Manhattan Railroad Company, in order to do away with the difficulty experienced by passengers in finding out what station they are approaching, is trying out a system of illuminated signs. Across the cars, in the center, hangs a large glass sign with the words, "Next Station." Alongside these appears, as the train leaves a station, the name of the next stop in letters of light.

Electric lights are concealed in the sign and are allowed to shine through on both sides. They are switched on and off by the guards, who have merely to shift a plug in a switchboard installed at the entrance to the cars.

Installs Horizontal Turbines.

The Cosmopolitan Electric Company of Chicago is installing two 3,500-kilowatt horizontal Curtis turbines at its plant at 2050 Grove Street.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, MAY 1.—In order to prevent the possibility of the National Telephone Company dismissing large numbers of their staff, owing to the company's unwillingness to spend capital which would not be remunerative during the few years which remain of its lease, and also the possible restriction of the expansion of the company's system for the same reason, the Government has expressed its willingness to take over the company's undertaking at once. This, of course, will involve an arbitration to determine the sum which will have to be awarded the company for prospective profits during the remaining three years of its license.

All the wireless telegraph licenses which have been granted hitherto have been dated to expire in 1912, and the Government has under consideration the question of whether these will be renewed or whether the various undertakings which are being worked by virtue of these licenses shall be acquired by the state. The Postmaster-General has frankly stated that the example given by the telegraph and telephone undertakings, which were allowed to grow up as outside companies and then had to be bought out, is being considered in connection with wireless telegraphy. No definite statement of policy on the point, however, has yet been declared.

It has been the common practice on our tramway systems to drive cars backward to a depot when one controller has got out of gear. Upon one of the London tramway systems a short time ago a boy was unfortunately killed by a car which was being so driven, and as a consequence a new by-law has been issued that any disabled car must be towed, and not pushed or driven backward.

The process of consolidating the numerous electric supply undertakings in London, which was made legal by the passing of the Act of Parliament last year, is being actively pursued by municipalities and companies alike. In order to arrive at a common understanding, the local authorities are to hold a conference shortly to consider the details of a definite scheme.

The Board of Trade and the Local Government Board are to be asked to conduct an inquiry as to the waste of money by the London County Council upon the G. B. surface-contact tramway experiment in London. The question is also to be brought up as to why the County Council decided to abandon the experiment in face of the advice of their own independent expert that it could be made to work satisfactorily and without danger to the public.

It is recommended by the Sheffield Corporation tramways committee that a route now served by ordinary motor omnibuses should be served by trolley electric omnibuses instead. This recommendation is the result of the visit of a deputation from Sheffield to the Continent. This deputation, however, reports to the corporation that the trackless trolley system would be of absolutely no use in the crowded streets of a city.

A passenger on a tramcar belonging to the West Ham Corporation has just been awarded $2,500 damages for injuries through an electric shock which he received by touching the trolley standard on the top deck while passing down the gangway. The passenger secured a verdict for this sum mainly for the reason that for any portion of the metal work of a tramcar to be "alive" is a contravention of the Board of Trade rules. The fact that the corporation displayed a notice in the car limiting their liability for accidents to $125 owing to the fares charged being less than the maximum authorized by the franchise, was held by the judge to be invalid, for the reason that the passenger was not given the alternative of paying the full scale fares, the payment of which would have transferred the full liability to the corporation. This point is of considerable interest and importance to tramway authorities here, as it is a common practice to limit liability in this way, although a test case had not previously been brought.

After protracted disputes, the Underground Electric Railways Company of London has succeeded in reducing the emission of black smoke from the chimneys of its large power station at Chelsea to an amount which meets with the approval of the local authority. In 1907 proceedings were taken against the company in the police courts, but the local authority was unsuccessful and had to pay $1,500 costs to the company. Nevertheless, the company has continued to make experiments in order to avoid so much clashing with the local people. One of the chief troubles which the company itself had to contend with was a choking of the pumps which pumped from the Thames for condensing purposes, thus causing a loss of vacuum. A "New" revolving wire mesh screen has been installed, at a cost of about $15,000, and the trouble seems to have been overcome. Another improvement has been the better regulation of the draft to the furnace doors, while a more suitable quality of coal, owing to lower prices, has also helped to reduce the trouble. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, MAY 1.—The Eastern Sicily Electric Company is engaged in erecting two hydraulic plants, which are to be operated jointly to furnish current for some of the principal cities, such as Messina and Syracuse. One of the turbine stations is located on the River Cassabile, using a 275-meter fall, and some 10,000 horsepower will be obtained. A storage basin of large capacity will be used in connection with the plant. On the Alcantara will be erected a second plant, which is expected to give 8,000 horsepower, using a 104-meter head of water, and it is intended to utilize other falls upon the same stream at a later date, with a storage basin that will considerably increase the output. The two plants mentioned above will be connected to a high-tension pole line, working at 40,000 volts, mounted on metallic poles, which is to run to Messina and Syracuse.

A new electric plant is to be installed at Bucharest, and the current will be mainly used for the lighting of the outlying districts, as well as for an electric tramway line, which is soon to be built there. Motors for industrial purposes will also be used upon the circuits.

There is a project under way in Germany for a light and power network of considerable extent in the Hesse province, and it will take in more than 100 communes, possibly including Mainz and Worms. According to the terms of the contract with the Schuckert Company, this latter is to operate the system for a period of fifty years maximum, and after thirty years the transfer can be made to the communes interested without any expense to them.

The French government is taking measures to develop the hydraulic resources in the south of France, and to this end recently appointed a prominent engineer, M. René Tavernier, to make a report on the possibilities of hydraulic power in the southwestern district, which at present has not been sufficiently developed, and an operating company may be formed at a later date. For the southeastern region, the streams belonging to the public domain are to be examined by Engineer De la Brosse in the district lying between the Rhone, the Mediterranean and the Alps. A. DE C.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

ELECTRIC RAILWAY DEVELOPMENT IN WASHINGTON STATE—French investors have purchased a $3,000,000 bond issue of a company which is to build an electric line seventy-five miles long in the state of Washington. The company is known as the Okanogan Electric Railway, and Albert M. Dewey of Spokane is its president. Ultimate plans call for extensions of the line which will make a system 500 miles in length.

CENTRAL GEORGIA POWER COMPANY—This company has made a mortgage to the Windsor Trust Company to secure an issue of $3,000,000 five per cent bonds, dated May 1, 1909, and due May 1, 1938, but subject to call at 105 and interest when drawn by lot, either for an annual sinking fund beginning in 1913 equal to one per cent of the bonds held by the public, or at the company's option on any semi-annual interest day.

THE CONEY ISLAND & BROOKLYN RAILROAD COMPANY—This company has notified the Public Service Commission that it is going to ask for permission to issue about $350,000 of bonds, to be used in the improvement of its right-of-way on the Franklin and De Kalb Avenue lines, borough of Brooklyn, New York city. These lines, in a recent investigation by the commission, were shown to be run down, and to need a considerable expenditure for rehabilitation. The company's new power house is now in operation, and power is generated at about one-third less cost per car-mile than previously.

PLANS OF ST. LOUIS SYNDICATE FOR LONG-DISTANCE TELEPHONE TRUNK LINES—An agreement was entered into on May 7 by officers of the Pittsburg & Allegheny Telephone Company and Max Koehler, of St. Louis, representing a syndicate of $20,000,000, which will erect and operate a long-distance telephone and telegraph line which plans to have its eastern terminus in Boston and its western in Kansas City. The company Mr. Koehler represents already owns outright the local companies in St. Louis, Kansas City and Joplin, Mo., and has extended its long-distance trunk lines as far east as Terre Haute, Ind., and

has a few long-distance lines in Ohio, including the properties of the United States Telephone Company. The syndicate recently secured a franchise in Boston, Mass., and will build long-distance lines, if permitted to begin operations, directly west and south to New York, where it has been striving for a franchise in the metropolis.

PLANS FOR POWER DEVELOPMENT ON FRENCH BROAD RIVER—C. E. Waddell, engineer for the North Carolina Electrical Power Company, of Asheville, N. C., has completed the survey for the proposed development on the French Broad River near Marshall, and it is understood that the construction work will begin as soon as the necessary contracts can be let. The development contemplates an outlay of $400,000 to $450,000, to be expended for a concrete and masonry dam 600 feet long and thirty-six feet high, generating plant and transmission lines to Marshall, Asheville and other towns nearby. Five or six thousand horsepower will be developed. W. T. Weaver is president of the company.

BOSTON SUBWAY PLANS APPROVED—All the legal procedures have been executed giving the Boston Elevated Railway Company the right to begin the construction of the Main Street subway in Cambridge. The State Board of Railroad Commissioners has approved the general plans for the route and for the three stations—Harvard Square, Central Square and Kendall Square. The Boston Elevated, it is stated, will at once begin work. The subway will run under Beacon Hill. The Boston end is to be built by the Boston Transit Commission, being the section for which bids were opened some time ago and held up through court proceedings; the Cambridge end is to be built by the Boston Elevated.

NEW TRACTION COMPANY FOR SAN FRANCISCO—Details in regard to the proposed new financing by the United Railways Investment Company are outlined in a letter to stockholders signed by Ernst Thalman, president. A special meeting will be held in Jersey City on May 17 for the purpose of ratifying and approving a contract entered into by the company with the protective committee of the Stanislaus Power Development Company. It is proposed to increase the capital stock by $10,000,000. All of the new stock will be preferred. A block of $10,000,000 of United Railroad of San Francisco common stock held in the treasury will be sold and the properties of the Stanislaus Power Developing Company acquired. A new company, to be known as the San Francisco Electric Railways, will be formed and will be controlled by the United Railways Investment Company.

AUTOMATIC TELEPHONE COMPANY PROJECTED—It is announced that the Public Service Telephone Company, of which John M. Shaw, a banker, of 46 Wall Street, is president, will ask for leave at once to lay wires in New York city. The company was incorporated several days ago. The other officers are J. A. L. Campbell, 50 Church Street, secretary, and G. S. Graham, C. D. Simpson, R. Conklin, A. G. Wheeler, Jr., and R. Robbins, directors. Capital of the company will be $10,000,000, divided equally into common and preferred stock, and bonds are authorized up to $25,000,000. It is the purpose of the company to lease for 999 years a franchise of the Long Acre Electric Light and Power Company to do a telephone business in New York city. This franchise, it is declared, will enable the new company to do business without additional powers from the city, although the company is willing to arrange to pay to the city "a reasonable percentage of its receipts." It is the intention of the company to use automatic instruments, which would do away with a central office.

INDIANAPOLIS COMPANY MAKING BIG EXPANSION—E. L. McKee, president of the Merchants' Heat and Light Company, Indianapolis, Ind., announces that his company will spend $1,000,000 this year in improving and increasing its facilities. The chief item is the erection of a $300,000 power plant at 740 West Washington Street, the site of which has already been purchased for $50,000. J. G. White and Company, of New York, are preparing the plans, and the power house is to be completed by December 1. Improvements have already been begun on the old plant of the company, New Jersey and Pearl streets, which has heretofore supplied all the subscribers of the company. The plans for these improvements are being superintended by the White Company, and include rearrangements and increase in facilities that will make the New Jersey Street plant a thoroughly modern one. This plant already is said to be the largest one of its kind in the world. The improvements on the New Jersey Street plant are to be finished by September 25. The Merchants' Company began a little more than five years ago and is now supplying heat and light to more than 300 of the largest business houses and other concerns in the downtown district.

LIGHTING AND POWER.

(Special Correspondence.)

TAFT, TEX.—The Coleman-Fulton Pasture Company is to establish an electric-light plant in this city.

HAWLEY, MINN.—A vote will be taken May 20 on issuing $16,000 bonds for an electric-light and waterworks plant at this point. C.

TRINITY, TEX.—A. R. McDonald intends to put in an electric-light plant here and has secured a franchise.

TRUCKEE, CAL.—The Donner Ice Company, of this city, is to install electric machinery for operating its plants.

SANDY HILL, N. Y.—The Caroga Electric Power Company, of Glens Falls, has been incorporated with a capital of $50,000.

BELLEVUE, KY.—The bid of the Union Light, Heat and Power Company for a ten-year electric-light franchise has been accepted.

ST. PETER, MINN.—The contract with the St. Peter Light Company to supply the village of Kasota, Minn., with electric light has been ratified. C.

EUREKA, CAL.—Jesse Knight will construct an electric power plant in Santanquin Canyon to generate power for the mines in this vicinity.

MUSKOGEE, OKLA.—R. J. Johnson and others have incorporated the Muskogee Electric Company, with the object of installing an electric-light plant at this point.

MERIDEN, CONN.—The Meriden Electric Light Company is to begin at once the building of an important and much-needed addition to the plant on South Colony Street.

DETROIT, MICH.—Butler Brothers & Hoff, contractors, will build the one-story concrete-steel power house or substation for the Detroit River Tunnel, at a cost of $100,000.

ST. PAUL, MINN.—Consideration by the committee on streets of the ordinance to reduce the maximum charges for electric lighting and power has been postponed for a month. C.

FARGO, N. D.—Charles L. Pillsbury, of Minneapolis, Minn., has been called into consultation as to the best method of furnishing power for the new water-pumping station here. C.

PINE CITY, MINN.—The Pine City Electric Power Company has let the contract for the installation of its machinery to the Fort Wayne Electric Works, Fort Wayne, Ind., for $10,000. C.

LAKE PRESTON, S. D.—The Town Council has passed an ordinance granting the Lake Preston Milling Company a franchise to install and maintain for twenty years an electric-light plant.

PROVIDENCE, R. I.—June 1 the management of the Narragansett Electric Light Company will reduce the price per arc lamp to $100 per year, a saving to the city of $4.75 per lamp per year.

LITTLE ROCK, ARK.—The city will issue $200,000 in bonds for the purpose of creating an improvement district, comprising the entire city. An electric-light plant will be installed after the issue is floated; $65,000 is to be expended on it.

PENSACOLA, FLA.—New electric-light and gas fixtures are to be installed in the government building here at once. Tungsten lights are to be used in place of those now in use, and there will be large globe lights in the corridors.

JOHNSTOWN, PA.—The Conemaugh Electric Company, recently incorporated at Harrisburg, Pa., with a capital of $50,000, has submitted a proposition to the City Council of Conemaugh, Pa., for the purchase of the municipal electric-light plant.

SOUTH BETHLEHEM, PA.—The Halcyon Electric Light and Power Company, which was awarded the contract by South Bethlehem Town Council to light the streets of that borough for the next five years, has reorganized, and voted to increase the capital stock of the company to $60,000.

SHELBURNE FALLS, MASS.—This town is to have continuous electric-light service, and as soon as the six new motors which have been ordered by the electric-light company are received and set up a long-felt want will be supplied. It is expected that the change will be made about the first of June.

LAURENS, S. C.—The Piedmont Electric Company, of Anderson, S. C., has been awarded the contract for installing electrical equipment at the Watts Mill at Laurens. An addition has recently been built to the mill and in this will be installed 300 lights and motors, with a total capacity of 1,460 horsepower. Work will be begun at once.

BREVARD, N. C.—The Transylvania Cotton Mill Company has completed the construction of its mill building, and is now installing an equipment of machinery, which will comprise 4,000 spindles, etc., driven by electricity, for manufacturing yarns. This power will be obtained from the Cascade Power Company, which has about completed its waterpower plant at Hamilton Shoals, on Little River, six miles from Brevard. This company will have a first capacity of 1,000 horsepower.

BUFFALO, N. Y.—Bids for the construction of the proposed electric lighting plant at city hall, which is estimated to cost about $25,000, have been received and opened. They include bids for electric wiring, manufacture of concrete, engines, ventilating, carpentry and masonry, tiling, painting, outside standards, lamps,

fixtures and the like. Most of the big electrical firms were represented in the bidding.

MATTOON, WIS.—F. C. Duchac, of Antigo, Wis., has petitioned the Village Council for a franchise to install and maintain an electric-light plant at that place. C.

LOS ANGELES, CAL.—The City Council has decided to let contracts to the amount of $45,000 for electric machinery to be added to the municipal lighting plant.

AUSTIN, TEX.—The Denison Light and Power Company, of Denison, Tex., has filed an amendment to its charter, increasing its capital stock from $125,000 to $200,000.

SAN DIEGO, CAL.—The San Diego Gas & Electric Company has increased its capital stock from $1,500,000 to $3,500,000. The company proposes to make extensive improvements to its plant in the near future.

OAKLAND, CAL.—The Great Western Power Company has let contracts to the Thompson-Starrett Construction Company to build a $45,000 steel substation in this city. Building operations are to begin at once.

SANTA ROSA, CAL.—The Snow Mountain Water and Power Company has contracted with G. W. Nelson for the construction of 17.58 miles of electric power lines to be built from Fulton to Guerneyville, at $300 per mile.

BANCROFT, NEB.—A bond issue of about $8,000 for the installation of a municipal electric-lighting plant is being considered by the authorities here. The measure will undoubtedly be passed and work probably be begun next fall.

WAITSBURG, WASH.—The Waitsburg Electric Light Company has decided to spend $3,000 this spring in remodeling and improving its power plant. Auxiliary power will be installed immediately to operate the plant during the low-water season.

KEARNEY, NEB.—The City Council of Kearney is in the market for a photometer for "testing the respective candlepower of electric and gas light." Price and description of the instrument are wanted at once, and an order will be placed if satisfactory.

FERGUS FALLS, MINN.—The Dayton Hollow Power Company will furnish Breckenridge, Minn., and Wahpeton, N. D., with electric lights, and is considering the extension of its lines to Mooreton, Wyndmere, De Lamere, Milnor, Gwinner and Oakes, N. D.

FULTON, N. Y.—As soon as its litigation with the state is compromised or otherwise ended the Fulton Light, Heat and Power Company proposes to spend about $500,000 for the purchase of waterpowers and the installation of a large hydro-steam electric plant.

WEST TERRE HAUTE, IND.—The West Terre Haute Light and Power Company has filed articles of incorporation with the Secretary of State. Current for light and power will be furnished the people of West Terre Haute and vicinity through the new company. S.

PENDER, NEB.—A municipal electric-lighting plant has recently been installed here, which is now in satisfactory operation. The plant is of 50-kilowatt capacity, with Western Electric alternating-current machine, direct-connected to Erie engine. P. A. Johansen is manager of the plant.

KNOX, IND.—The Knox Electric Light and Water Company has been incorporated, with Frank A. Green, William S. Daniels, Thomas A. Grist and Gus Reiss as directors. The company proposes to build and install a combined lighting and waterworks plant in Knox. S.

LAKE PRESTON, S. D.—An ordinance has been passed granting a twenty-year franchise to the Lake Preston Milling Company to install and maintain an electric-light plant. The capital of the company has been increased $5,000 to pay the cost of the construction of the plant. C.

FT. WAYNE, IND.—The McBride Electric Company of St. Paul, Minn., is asking a judgment from the Federal Court against the city of Ft. Wayne for $26,608.26, with interest and costs. It is alleged this amount is due as a balance unpaid for constructing the municipal lighting plant. S.

MEMPHIS, TENN.—Arrangements are now being made by collector of customs to improve the lighting system in the federal building. The old part of the building will be rewired and new fixtures and appliances will be installed throughout. The new tungsten light will be installed on the ground floor in place of the old-style incandescent lamps now in use. The whole system will be entirely remodeled this spring.

PARIS, ILL.—It is only a small affair, but touches on the difference between municipal and private ownership. The little village of Kansas, Ill., nearby, is about to sell its municipal electric-light plant. The board of trustees of the village value the plant at $4,000, and the purchaser will take it at that price and pay for it by furnishing street lights to the village for seven years in payment. The price and the interest on the same will make it cost the village about $700 per annum for electric lights, while the present cost is about $660 a year for the engineer alone, besides the bills for repairs and fuel!

TONOPAH, NEV.—The Nevada-California Power Company announces that its new electric power line to Pioneer will be complete and in operation by the end of May. Among contracts closed last week was one with the Bullfrog-Pioneer Mining and Leasing Company to install a 50-horsepower electric hoist.

SOUTH BETHLEHEM, PA.—The Halcyon Electric Light and Power Company, which was recently awarded the contract for street lighting, has been reorganized and an increase in the capital stock to $60,000 voted. A. C. Graham is president of the company, P. F. Enright secretary, and H. M. Ueberroth treasurer.

INDIANAPOLIS, IND.—Mayor Bookwalter is planning to carry out a new scheme of electric lighting in the business districts of the city, to consist of great arches and ornamental metal poles, to be used jointly by the city and the street railway. The lighted district is to be known as the "Great White Way." S.

HUSUM, W. VA.—The falls at this point, noted for many picturesque features, are to be used to supply power for the electric-light plant now nearing completion. White Salmon, Bingen, Underwood and Husum will soon be provided with arc and incandescent lights, the current to be derived from the power plant here.

BETHLEHEM, PA.—The Halcyon Electric Light and Power Company, which was awarded the contract to light the streets of South Bethlehem for the next five years, has reorganized, with an increased capital stock of $60,000. The new officers are A. C. Graham, president; P. F. Enright, secretary, and H. M. Ueberroth, treasurer.

JEFFERSON, IOWA—The City Council has passed an ordinance in behalf of the Jefferson Light, Heat, Power and Water Company, providing for a new twenty-year franchise. The old franchise did not expire for two years, but it was desired to float a new bonded indebtedness to provide for extensions and improvements.

CHICAGO, ILL.—A mortgage of $250,000 has been issued to the Chicago Savings and Trust Company to secure a bond issue of the same amount by the newly formed Iowa City Gas and Electric Light Company, which bought the property of the Iowa City Electric Light Company and the Iowa City Gas Light Company for $500,000.

FRESNO, CAL.—The San Joaquin Light & Power Company will soon begin improving its electric power lines to the suburban towns, at a cost of upward of $1,000,000. A large increase will be made in the size of Plant No. 1. The present capacity is 2,500 horsepower. It will be enlarged by 10,000, making a total of 12,500 horsepower.

NOBLESVILLE, IND.—The White River Light and Power Company, which is constructing a hydraulic dam across White River, two miles north of this city, has issued $150,000 worth of bonds. The money will be used to complete the dam. The company is proposing to furnish electricity for light, heat and power to many towns in central Indiana.

CHICKASHA, OKLA.—The Chickasha Light, Heat and Power Company will immediately begin the reconstruction of its entire plant in this city, and within a short time will have in operation a complete new generating system, driven by new engines of the best type in every respect. Contracts for the new units, which will probably be high-pressure steam turbines, will be let very shortly.

BATTLE MOUNTAIN, NEV.—The Lander County Power and Light Company has been formed by local capitalists and in a short time the construction of a big electrical power plant will be commenced for the lighting of this town. Much of the power will be used for the operation of the Golconda Consolidated Mining Company's plant and hoisting works, and for the operation of other hoisting works in this vicinity.

ORANGE, N. J.—The city of Orange has decided in favor of building a municipal lighting plant by a majority of more than 400 in a total vote of 2,500. The plant is estimated to cost $87,000, and it is asserted light can be produced for $63. The city is now paying $85. There has been a long campaign, in which the sinking fund commission of the city circulated a statement urging taxpayers to vote against the proposition. This statement is believed to have acted as a boomerang, and the action of the commissioners, in assuming authority outside their duties, resulted in many votes for the city plant.

MONTGOMERY, ALA.—Some time ago the Montgomery *Journal* made the suggestion to have the state capitol lighted at night with electricity. This suggestion has been taken up by the public and a popular movement has been inaugurated. It is expected that within a month the lighting of the dome will have been completed, as sufficient guarantees of financial contributions warrant the carrying out of the plan. Mayor W. M. Teague has consented to receive contributions and act as treasurer of the

popular fund. The Montgomery Light and Water Power Company will take charge of the plan of equipping the lighting scheme and maintaining the system.

FT. WAYNE, IND.—There is such a keen competition between the city municipal lighting plant and the Wabash Valley Traction Company for the sale of electricity here that the Government secures current at a flat rate of four cents. The city originally bid eight cents with reduction according to the amount used. The Government, it is stated, has been paying the traction company ten cents. S.

GATUM, PANAMA CANAL ZONE—A transmission line is being erected to connect Cristobal and Colon with the large electric-generating plant now being built at Gatum. The latter will be a permanent plant, and as soon as put in operation will be able to supply all the electrical energy required for lighting and power at Gatum as well as at Colon and Cristobal, thus permitting the shutting down of the plants now operating in the latter cities.

SALEM, MASS.—The committee on street lighting seem satisfied with their new installation of tungsten lamps. They issue a statement as follows: There are now 50 tungstens, and they cost a total of $1,100, where the arcs cost $2,375. The former will cost $546 and the latter have cost $1,710 a year. In the changes already made and those to be made, the saving will be about $2,500. The City Council directed the committee to cut down lighting expenses $2,000 this year.

SPRINGFIELD, OHIO—The City Council has passed an ordinance fixing the rate by which the Springfield Light, Heat and Power Company shall furnish current at a sliding scale of five to eight cents per 1,000 kilowatts, with a discount of three-tenths per cent rating per watt upon the return of lamps. The merchants' contention for the employment of an expert lost, but they secured the rebate clause, which will help some where modern lamps are used. The ordinance is for a period of five years.

LANCASTER, N. H.—According to present plans, a big water-power project on the Connecticut, between Munroe and Dalton, is being promoted by Chicago capitalists, involving the development of 5,000 horsepower and the expenditure of five or six millions of dollars. C. E. Everett, of Chicago, representing the Chicago and New York men, is the promoter in charge of the project. The first and biggest dam will be built across the river at Munroe, where there is a natural gorge for the foundation of the big dam. This dam alone would probably cost at least $2,000,000.

ALBANY, N. Y.—The New York State Public Service Commission for the Second District has received the following application to issue bonds: Palmyra Gas and Electric Company, to make a mortgage for $100,000, and issue $60,000 in bonds, of which $35,325 is to be used for discharge of obligations, and $14,000 to make extensions and betterments. Norwich Gas and Electric Company, to make a mortgage for $400,000 and to issue $170,000 in bonds, $85,000 to retire an outstanding issue, $36,000 to discharge obligations and $40,000 for extensions and betterments.

NIAGARA FALLS, ONT.—General Manager F. B. H. Paine of the Niagara, Lockport & Ontario Power Company, states that the company, although it does not expect a recurrence of the unusual conditions which caused the serious trouble at the plant recently, does not intend to take any chances, and has taken the precaution to block up the windows and all other openings to a height several feet above the point to which the water rose this year. The company expects this summer to do this work in a permanent manner so as to provide even against such extremely abnormal conditions as occurred last month.

BIDDEFORD, ME.—The Pepperell Manufacturing Company has awarded a contract to the York Light and Heat Company to install twelve motors in its plant, to be used in furnishing power for operating the company's mill. An expenditure of about $40,000 is being made by the Pepperell company for furnishing power and light for its mills, the contract of the York Light and Heat Company amounting to about $10,000. The Allis-Chalmers Company, Milwaukee, Wis., is at present installing a 1,500-kilowatt generator, which will supply light for all the mills of both the Pepperell and Laconia divisions, and also power for the machinery in a portion of the mills.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MOLINE, ILL.—Work on the Rock Island Southern new interurban line has just been started.

INDIANAPOLIS, IND.—The United States Express Company has made arrangements to operate its express business over 1,400 miles of interurban railways in Indiana.

FORT WAYNE, IND.—The Wabash Valley Traction Company has ordered ten new cars for city operation. They will be "pay-as-you-enter cars." The good remunerative work spreads.

FRESNO, CAL.—The Fresno Traction Company will spend $300,000 in improving its system in this city. Its entire system will be double tracked and the old rails replaced with seventy-five-pound steel, and a new car house will be built within the city limits.

SIOUX CITY, IOWA—An interurban railway from Sioux City to Centerville, S. D., is projected. C.

ABERDEEN, S. D.—Chicago capitalists have applied for a franchise to construct a new street-car line here. C.

WAYNESBURG, PA.—Work is to be started at once on the construction of a trolley line from Waynesburg to Claysville.

GUTHRIE, OKLA.—The Washita Power and Traction Company of Chickasha, Okla., has been incorporated with a capital of $50,000.

SEATTLE, WASH.—The Seattle Electric Company has been granted a franchise to operate electric cars on certain thoroughfares in this city.

LANCASTER, PA.—An extension of the trolley line from Ephrata to Lebanon will be made. Subscriptions are now being solicited and the work of constructing the line will be begun at once.

MANKATO, MINN.—May 1 the Mankato Electric Traction Company completed its first year of operation. During that time its cars traveled a distance of 272,664 miles and carried 700,000 passengers. C.

EXCELSIOR SPRINGS, MO.—An extension of six months on the franchise of the Kansas City, St. Joseph & Excelsior Springs Railway Company has been granted by the Excelsior Springs City Council.

BANGOR, PA.—The Mountain View Trolley Company is again trying to get a franchise from the Water Gap Council in order to extend its line to Portland, where it will connect with the B. & P. trolley line.

SANTA ANA, CAL.—The Los Angeles Pacific Electric Railway Company has signed contracts whereby it binds itself to complete its electric road between Santa Ana and Huntington Beach before July 1.

NASHVILLE, TENN.—The first meeting of the board of directors of the Nashville & Crocker Springs Rapid Transit Company has been held, and engineers have been put to work surveying the line to Crocker Springs.

WABASH, IND.—After this week twenty "limited" cars will be run between Fort Wayne, Ind., and Indianapolis, passing through Wabash and Peru. The "limited" train is quite put into the shade by the limited trolley car.

BELLINGHAM, WASH.—The Whatcom Railway and Light Company announces extensions to be made this summer which will cost in the neighborhood of $204,000. The first extension to be made will be the new Donovan line.

NEW YORK, N. Y.—Sixty pay-as-you-enter cars have been installed on the Eighth Avenue line of the Metropolitan Street Railway Company. As soon as possible the new cars will be installed on the other lines of the company also.

IOWA CITY, IOWA—Surveyors are at work, and right-of-way is being secured, between Iowa City and West Branch. The interurban project—linking Iowa City, Cedar Rapids, Davenport, West Branch and Tipton—is now considered probable.

EVANSVILLE, IND.—The extension of the Evansville & Eastern, from Rockport, Ind., to Grandview, Ind., will be built this summer. The line will then be surveyed on to Louisville and the latter city connected with Evansville by trolley.

LOS ANGELES, CAL.—The Ontario & San Antonio Heights Railway Company has secured rights-of-way for its road between Uplands and Claremount, a distance of six miles, and will begin construction work at once. It is estimated that the work will cost $175,000.

WARSAW, IND.—A franchise has been granted to the Wabash & Northern Interurban Company, with which J. A. Barry and William H. Moyer are identified. The franchise calls for the completion of the work in Warsaw and to a point five miles south of the city by January 1, 1910.

BLOOMINGTON, ILL.—The extension from Joliet to Chicago Heights will be finished in about ten days, and work on the Bloomington-Pontiac line is being proceeded with. Construction has been started from Pontiac south, but the Joliet-Wilmington end will have to wait on track elevation in Joliet.

PARKERSBURG, W. VA.—The Coal and Coke Railway has awarded the contract for an extension of its road in Braxton County, connecting the towns of Gassaway and Sutton. The track is to be finished by next October. By this road the town of Sutton will be connected with the Coal and Coke Railway.

LAKEWOOD, N. J.—It is said that H. H. Rogers, of the Standard Oil Company, is interested in the new Lakewood and Point Pleasant trolley line. This proposed line is the first link in a road connecting Trenton with Point Pleasant, and was surveyed and estimated several years ago. With the trolley in

running condition next fall Lakewood will easily be a strong rival with Atlantic City, as a seaside winter resort. The necessary deposit for the building of the line has been made with the state treasurer.

NEW YORK, N. Y.—The Board of Estimate has granted a franchise to the South Shore Traction Company to construct and operate a trolley line over the Queensboro Bridge along Division Avenue and Hoffman Boulevard, and through the former village of Jamaica to the dividing line of the counties of Queens and Nassau.

SPOKANE, WASH.—The Panhandle Electric Railway and Power Company has been incorporated to build an electric railway from Priest River, Idaho, to Priest Lake and the international boundary, with a proposed line between this city and Priest River. Rights have also been secured to build railways into Oregon.

JANESVILLE, WIS.—The City Council has granted a franchise to the Cincinnati Construction Company to construct, maintain and operate tracks in this city. The company already has been granted franchises by the Stoughton and Edgerton councils, and is expected to start building its interurban line between Janesville and Madison.

EVERETT, WASH.—Suits for the condemnation of a right-of-way have been commenced by the Everett & Cherry Valley Traction Company against several obstinate property owners in the vicinity of Tualco, who refuse to sell their land. This is the company organized in 1907 by J. T. McChesney and associates, in Everett public service corporations.

JANESVILLE, WIS.—The Common Council has granted a franchise to the Cincinnati Construction Company to run urban and interurban cars along the streets of Janesville. This is the company which plans to build an interurban between Madison and Janesville. The work will be begun as soon as the franchise is obtained from the railway commission.

PARKERSBURG, W. VA.—F. D. Blodgett of Zanesville, who is promoting the proposed Zanesville & Meigs Valley Traction Line, has commenced the survey from the Belpre end of the line. A force of men is at work here and will push the survey as rapidly as possible to Beverly. The line is to be operated by the Marietta, Parkersburg and Interurban System.

SPARTA, ILL.—Articles of incorporation for the St. Louis and Chester Railway Company have been filed in the office of Secretary of State Rose. The principal office will be located at East St. Louis. The capital stock is $100,000. The proposed line is to be constructed from East St. Louis to Chester, passing through the counties of St. Clair, Monroe and Randolph.

ALBANY, N. Y.—The Public Service Commission, Second District, has authorized Leslie Sutherland, receiver for the Yonkers Railroad Company, to issue $100,000 six per cent receiver's certificates, payable in not less than two years. The proceeds are to be used for renewal and reconstruction in Yonkers and the purchase of new rails and other things necessary.

NEW YORK, N. Y.—The Public Service Commission has modified its previous action refusing approval of the franchise granted to the Union Railway Company by the Board of Estimate and Apportionment for the construction of an extension on Pelham Avenue in the Bronx and now recommends that if the road complies with certain conditions the permission will be granted.

OKLAHOMA CITY, OKLA.—At a special election, held by virtue of the initiative and referendum law at Oklahoma City, on April 27, the Oklahoma Interurban Traction Company were granted a blanket franchise to the streets, avenues and alleys of Oklahoma City. Construction work on an interurban will be commenced at once, the franchise conferring all necessary entrance facilities.

LEWISTOWN, PA.—The Lewistown & Reedsville Electric Railway Company has been reorganized with the election of the following officers: President, J. I. Quigley, of Lewistown; vice-president, J. E. Zimmerman, Philadelphia; treasurer, C. Day, Philadelphia; directors, J. E. Zimmerman, A. A. Stevenson, D. A. Pearson and C. Day, of Philadelphia, and J. I. Quigley and A. B. Spanogle, of Lewistown, and W. P. Stevenson, of McVeytown. The purchase was made by the Utilities Corporation, of New Jersey, with $1,000,000 in preferred and $1,000,000 in common stock.

LEWISTOWN, PA.—Concentration is the order of the day in this locality. It is said that the Hydro-Electric Company, with behind it the Weightman estate of Philadelphia and the recently capitalized Utilities corporation with capital stock of $2,000,000, is to buy up and merge street railways and lighting plants. The Lewistown & Reedsville line was acquired last week and now it is the Lewistown Light, Heat and Power Company. A very extended system of interurban railways is contemplated by the Hydro-Electric Company which has been building a plant at Warrior Ridge at a cost of $2,000,000. Located on the main stem of the Juniata River, the plant has almost unlimited facilities for the manufacture of electric power. The company has extended their wires and power furnishing facilities westward as far as Altoona, twenty-nine miles, and eastward as far as this place, forty-six miles.

BOSTON, MASS.—The Middlesex & Boston Street Railway (a Boston suburban company subsidiary) has petitioned the railroad commission for an increase in stock by $822,000, divided into 8,220 shares, par $100, for purpose of effecting a consolidation with the Newton Street Railway Company into the Middlesex & Boston Street Railway Company, for approval of which consolidation the company petitions.

LAWRENCE, KAN.—The city of Lawrence, probably the largest city in the state of Kansas without a street railway system, is to have one, and a good one. The Lawrence Railway and Light Company, which was granted a charter in March, has applied to the state charter board for permission to increase its capital stock from $10,000 to three-quarters of a million dollars—$750,000—and the permission has been granted.

SAN FRANCISCO, CAL.—A $2,000,000 bond issue for the construction of a municipal street railway on Geary Street was passed by the Board of Supervisors last week, to be laid before the voters in June. Overhead trolley traction and the most improved types of cars and tracks with 100-pound Trilby rails were decided upon. The entire length of the reconstructed road will be seven miles. The cost is figured at $1,994,232.

CINCINNATI, OHIO—The Cincinnati Traction Company is spending nearly $100,000 on new track work, and about 800 men are employed now. If the proposed bond issues for the improvement of a number of streets goes through every one of these streets that contains car tracks will be equipped with new rails. The new rails are laid in concrete, giving a solid foundation, and are of the heaviest type of rails rolled, weighing 104 pounds to the yard.

ST. PAUL, MINN.—St. Paul and Minneapolis are soon to have another continuous interurban street-car line, one that will afford a trip through Fort Snelling. As soon as the grading on the St. Paul approach is finished the Twin City Rapid Transit Company will begin laying the tracks through the reservation to the Fort Snelling line from Minneapolis. The War Department has just granted a license to the street car company to construct the line.

BEAVER, PA.—Approximately $3,000,000 will be expended for a new electric line from Coraopolis along the Ohio River to Monaco. Actual construction will be started during the summer and the new line will be ready for service early next year. While the road is being built chiefly to connect Pittsburg and a number of the small towns below Coraopolis, another object is to accommodate residents of the new steel town to be built at Aliquippa by the Jones & Laughlin Steel Company.

BELLOWS FALLS, VT.—Former stockholders of the Mount Mansfield Electric Railway Company have bought the road from A. H. Soden of Boston. The new corporation has elected the following directors and officers: Directors, A. H. Soden of Boston, Fred J. Shepherd of Boston, Charles Bartlett of Derry, N. H., L. C. Moody of Waterbury, C. E. Burt, C. L. McMahon, and W. B. McCutchan of Stowe; president, A. H. Soden; vice-president and general manager, C. E. Burt; clerk, L. C. Moody; treasurer, W. B. McCutchan.

WHITE PLAINS, N. Y.—The New York, Westchester & Boston Railway Company has put 800 men to work on its new rapid transit electric lines in Westchester County. The company not only intends to complete the line to Port Chester, but will push the work on the White Plains branch line, which is to run from New Rochelle across to Elmsford, passing through Tuckahoe, Scarsdale and White Plains. The latter line is to be a rival of the Harlem Railroad. The company expects to have the entire road completed in a year.

SACRAMENTO, CAL.—Articles of incorporation for the Sacramento & Sierra Railroad have been filed. The purpose is to construct and operate a railway for a distance of 126½ miles, to Orangeville, Rattlesnake Bar, Pilot Hill, Georgetown, Jackson Springs and Lake Tahoe. The road will start from Sacramento. The capital stock is $1,000,000, of which $129,500 has been subscribed. There has been an intimation that gasoline motors would be used where the grades would permit, and that electricity would be utilized in the mountains.

HUDSON, MICH.—The Toledo & West Michigan road, operations on which were discontinued some time ago for lack of funds, promises to become an assured success in the near future. At a recent meeting of the company at Adrian part of the business transacted was the authorization of an issue of $800,000 in notes bearing six per cent interest, to W. C. Ross of Chicago, for the purpose of building the road. Mr. Ross has contracted to secure the right-of-way and commence work by May 15, and expects to have the road running by the close of the year. The proposed line is to run from Adrian through Clayton, Hudson, Pittsford, Hillsdale, Jonesville and Quincy to Coldwater.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

HAMPTON, IOWA—The Iowa Telephone Company is to erect an office building here. C.

MILFORD, IOWA—The Midland Telephone Company has increased its capital stock to $50,000. C.

LEBANON, PA.—The Schaefferstown Rural Telephone Company has been chartered; capital, $10,000.

GRAND, OKLA.—The Pinkerton Telephone Company has been incorporated with a capital stock of $2,500.

NIXON, TEX.—The Nixon Telephone Company has been incorporated with a capital stock of $6,200.

WELSH, LA.—The Planters' Telephone Company has been incorporated with a capital stock of $25,000.

HAZARD, NEB.—The Hazard Telephone Company has been incorporated with a capital stock of $10,000.

OCONTO, WIS.—The Oconto Rural Telephone Company has been incorporated with a capital stock of $5,000.

BOONE, IOWA—The Boone County Telephone Company will install an entire new plant at a cost of $125,000. C.

STEVENSVILLE, MONT.—The Montana Independent Telephone Company will shortly have a line to Missoula. C.

LEAGUE CITY, TEX.—J. E. Walker, of this town, is organizing a company to establish a telephone system here.

VINTON, IOWA—The capital stock of the Western Telephone Journal Company has been increased from $10,000 to $20,000. C.

MARMADUKE, ARK.—The Independent Rural Telephone Company has been incorporated by J. A. Kribbs and associates.

ADDINGTON, OKLA.—The Jefferson County Telephone Company has been incorporated by R. M. Golden and associates.

SANTA ROSA, CAL.—The Red Hill Telephone Company has been incorporated here by H. Ehlers, R. Mazza and A. Richioli.

LUXEMBURG, IOWA—The Luxemburg & Millville Telephone Company has completed its first line between Luxemburg and Millville. C.

MASON CITY, IOWA—The Western Electric Telephone Company will rebuild its line to Algona at an expense of several thousands of dollars. C.

ST. LOUIS, MO.—The Bell Telephone Company is having plans prepared for the construction of a $500,000 twelve-story telephone building at Pine and Tenth streets.

PORTSMOUTH, N. H.—The New England Telephone Company will expend about $8,000 in extending its service between York Harbor and York Beach this spring.

MADISON, WIS.—The Assembly refused to refer to the people the Cleary bill, prohibiting duplication of telephone lines and providing for physical connection between companies.

COLUMBUS. OHIO—The Somerset Telephone Company, Newark, has been incorporated with a capital of $25,000; also the Farmers' Mutual Telephone Company, of Gillmore, capital $2,000.

PORTLAND, ME.—The Canadian Telephone Company has been organized at Kittery with $500,000 capital, nothing paid in; president, H. Mitchell, Kittery, Me.; treasurer, S. J. Morrison, Portsmouth, N. H.

ST. PAUL, MINN.—The Omaha Railroad has to build eighty-seven miles of new signal and telegraph lines to St. James, Minn., to replace the lines put out of commission last winter during the heavy storms. C.

DENVILLE, APRIL 30—The new experimental telephone line, built over the Boonton branch of the Delaware, Lackawanna & Western, for reporting trains, was opened last week. The operators welcome the change.

SACRAMENTO, CAL.—An ordinance has been passed ordering all wires, except trolley wires, to be placed underground. The telephone and telegraph companies are given three years in which to make the change.

BOSTON, MASS.—The Telephone Improvements Company has been incorporated, with a capital of $50,000, to manufacture telephone apparatus. F. F. Phillips, Jr., is president, and C. M. Wood, treasurer, both of Boston.

GEORGETOWN, IND.—The Georgetown Telephone Company has incorporated to construct, equip and operate a telephone exchange and telephone system in Georgetown and Harrison County. A. B. Goodner, president. S.

COLUMBUS, OHIO—A law has been passed to protect telephone users in the state of Ohio. This law makes it a misdemeanor, punishable by fine and imprisonment, for any person connected with a telephone company or engaged in telephonic transmission of messages, who divulges a private telephone message or who wilfully delays the transmission of such a message with intent to injure, deceive or defraud the sender or receiver of the message.

SEATTLE, WASH.—The United Wireless Telegraph Company has received a contract from the Alaska Steamship Company to install immediately wireless-telegraph apparatus on the steamers Seward, Olympia and Dolphin.

BROWNSVILLE, TENN.—The Cumberland Telephone Company has a large force of hands at work here on the telephone lines, putting in new lines and cables. The company now has about 500 phones in the town and several hundred in the county.

TRENTON, N. J.—A certificate of incorporation has been granted to the Alabama & Tennessee Telephone and Telegraph Company, Hoboken, capital $200,000. The incorporators are George A. Berger, George B. Fielder and Frederick W. Schaeffer.

RENO, NEV.—The Postal Telegraph and Cable Company has begun active work on its proposed line from Reno to San Francisco by filing a suit in the District Court to condemn rights-of-way on land belonging to the Southern Pacific and Central Pacific Railroad companies.

ELKHART, IND.—The Home Telephone Company of Elkhart and the Bell Telephone Company have entered into an agreement whereby the Bell Company surrenders its local business and removes its exchange and wires in exchange for a proportionate share of the long-distance toll-line business. S.

SEATTLE, WASH.—Manager Peter J. Lynch, of the Pacific Telephone and Telegraph Company, announces that the company will spend $1,500,000 in Seattle during the next two years, in new substations, extensions, and in changing some of the overhead wires to an underground conduit system.

HATTIESBURG, MISS.—The long-distance line connecting Hattiesburg and Jackson has been completed. Exchanges have been installed at Seminary, Collins, Mt. Olive, Mendenhall and other towns along the line of the Gulf & Ship Island. Work has also been started on the line between Hattiesburg and Gulfport.

FT. WAYNE, IND.—The Home Telephone Company is in the market for material for the construction of a six-multiple conduit system leading through Wells and Superior streets into Bloomingdale, a well-populated suburb. The extension will require 1,000 feet of 400-pair cable, 2,000 feet of 300-pair cable and 1,500 feet of 200-pair cable.

COLUMBIA CITY, IND.—The Home Telephone Company is installing a new central-energy switchboard of more than 1,000 capacity. The batteries will be charged from the city electric-light plant and a gasoline engine and dynamo will be kept in readiness in case anything happens to the light plant. All the wires in the city will be incased in cables. S.

DES MOINES, IOWA—George H. Messenger, of Linden, Iowa, fiscal agent for the Long Distance Independent Telephone Company, of Omaha, and president of various Iowa banks, is responsible for the statement that "the independent telephone companies from the extreme east to the middle sections of the country will be united for long-distance purposes before many years have passed. Trunk lines will be constructed, and when this is done one can talk just as far over the independent lines as he can now over the Bell system. One cannot talk now from Des Moines to Indianapolis over the independent lines, but it will not be long until this is possible." Mr. Messenger was in attendance at the meeting of independent telephone managers of Kansas City a month ago. Plans were partly made at that meeting, he says, for the merging of the independent systems on long-distance business. Mr. Messenger will attend the mammoth meeting of "independents" in Rochester, N. Y., at the end of the month.

TOLEDO, OHIO—The United States Telephone Company (the independent long-distance line) will make a cut, it is stated, of about one-third in its rates. James S. Brailey, Jr., president of the United States Company, gave out an interview recently in which he said: "The railroads have found that they can make more money under a two-cent fare, and we believe the telephone men can profit by their experience. When the railroad rates were high there was not so much travel as there is now. The increase in travel has more than made up the deficiency in money occasioned by a drop of two cents from three cents a mile. If the telephone toll is reduced more people will use the telephone."

It is announced that the rates for short distances will remain the same, but the rates for long distances will be lowered about one-third. The present rate from Toledo to Cleveland is 60 cents for three minutes' conversation; to Indianapolis, $1.15 for the same length of time; to Detroit, 25 cents, and to Columbus, 50 cents. Under the new ruling the rates will be about 40 cents to Cleveland, 75 cents to Indianapolis, 15 cents to Detroit, and 35 cents to Columbus. The night rate will be subject to the same change. The Bell Company has announced to its big toll customers a big discount on all telephone bills that reach a stipulated amount. The Bell has also cut rates, and the following schedule has been published, showing to what extent the competition has gone. Before the cut the toll from Toledo

to Cleveland was 85 cents; to Detroit, 25 cents; to Columbus, 70 cents, and to Cincinnati, $1.25. Under the new rule now in effect the rate to Cleveland is 45 cents; to Detroit, 20 cents; to Columbus, 50 cents, and to Cincinnati, 90 cents. H.

ELECTRICAL SECURITIES.

There was a moderate rally in the markets last week, and under the influence of improving conditions in many lines there was much speculative buying, and, also, considerable investment purchasing by the public.

Dividends have been declared upon the following electrical securities: The regular quarterly dividend of one and one-fourth per cent on the guaranteed stock of the American Telegraph and Cable Company, payable June 1. Brooklyn Rapid Transit Company; the regular quarterly dividend of one per cent, payable July 1. Georgia Railway and Electric Company; the regular quarterly dividend of one-and-one-half per cent on the common stock, payable May 20. Northern Ohio Traction and Light Company; the regular quarterly dividend of one-half of one per cent, payable June 15. Des Moines Electric Company; an initial dividend of three per cent on the preferred stock, payable May 15. Mobile Electric Company; a quarterly dividend of one-and-one-half per cent, on the preferred stock, payable May 10. Springfield & Xenia Railway; a dividend of one-and-one-half per cent, payable May 5.

ELECTRICAL SECURITIES FOR THE WEEK ENDED MAY 8.

New York:	*Closing.*
Allis-Chalmers common	16
Allis-Chalmers preferred	50½
American Tel. and Tel. Company	140⅞
Brooklyn Rapid Transit	79
General Electric	160⅜
Interborough-Metropolitan common	16⅜
Interborough-Metropolitan preferred	46¼
Kings County Electric	121
Mackay Companies (Postal Telegraph and Cables) common	78¾
Mackay Companies (Postal Telegraph and Cables) preferred	73¼
Manhattan Elevated	146
Metropolitan Street Railway	29
New York & New Jersey Telephone	122
Western Union	77
Westinghouse Manufacturing Company	83½

At the annual meeting of the New York Telephone Company all the directors were re-elected.

Boston:	*Closing.*
Edison Electric Illuminating	250
Massachusetts Electric	—
New England Telephone	132
Western Telephone and Telegraph pref.	85

At the annual meeting of the New England Telephone and Telegraph Company the directers were re-elected.

The Railroad Commission has authorized the Boston Elevated to sell at auction in Boston, at not less than par, paid for in cash, the 1,501 unsubscribed shares of the 66,500 shares authorized by the board in December, 1908.

At an adjourned special meeting of the Edison Company, of Boston, stockholders, by the necessary two-thirds vote of the total outstanding shares, including the recent new issue, voted to authorize the purchase of additional electric property. The vote taken on this question at the meeting the previous week was a majority vote. The meeting was further adjourned pending the filing of a petition with the Gas Commission for its approval of the proposed purchase.

Philadelphia:	*Closing.*
Electric Company of America	12¼
Electric Storage Battery common	48
Electric Storage Battery preferred	48
Philadelphia Electric	11⅞
Philadelphia Rapid Transit	32⅜
United Gas Improvement	86

The Philadelphia Rapid Transit Company has put in force a five-cent fare and abolished six-for-a-quarter tickets. It declares that average fare in the past nine months has been 3.9 cents; of all riders, forty-eight per cent paid full five-cent fare; eight per cent rode on exchange tickets, or a four-cent fare; thirty-one per cent rode on package tickets, or four-and-one-sixth cents; thirteen per cent rode on free transfers. With this average the company in the current year could hardly meet expenses and charges, and next year it must assume an additional fixed charge of $125,000 on $5,000,000 bonds, while in 1912 it must begin to accumulate a sinking fund that in forty-five years will total $30,000,000. It is declared that the lost interest on $30,000,000 capital paid in by stockholders will amount by July 1 to $6,239,725. The directors believe stockholders will agree to waive the cumulative dividend clause of the contract with the city.

Chicago:	*Closing.*
Chicago Telephone	132½
Commonwealth Edison	114¾
Metropolitan Elevated preferred	50
National Carbon common	85
National Carbon preferred	118

PERSONAL MENTION.

C. A. S. HOWLETT, of the Western Electric Company, has been elected president of the National Sales Managers' Association.

COUNT JOHANN VON BERNSTOFF, the German ambassador to the United States, was a visitor to the Allis-Chalmers plant, Milwaukee, Wis., last week.

J. D. A. CROSS, formerly of Des Moines, Iowa, representing the General Electric Company, has taken charge of the heating device department, with headquarters in Chicago.

PROFESSOR MORGAN BROOKS, of the department of electrical engineering of the University of Illinois, has been granted a leave of absence for the purpose of foreign travel and study during the coming academic year.

JOHN DAVIDSON has been appointed district manager for the Bell Telephone Company of New York city. Mr. Davidson is a lawyer by profession and has already done some executive work for the Bell Company. He will have his headquarters at Syracuse, N. Y.

J. H. GULICK, auditor of the Commonwealth Edison Company, Chicago, has been appointed secretary and treasurer of the North Shore Electric Company, to succeed Fred Insull, who resigned to take up work in the Rocky Mountains. Mr. Gulick is an officer of the Commonwealth Company.

B. ELSHOFF, for twelve years assistant superintendent of the Allis-Chalmers-Bullock factory at Cincinnati, and for the past two years superintendent of the electrical department of the Allis-Chalmers Company, of Milwaukee, has recently severed his connection with the last-named concern. Mr. Elshoff for the present will remain in Milwaukee.

W. R. D. OWEN, for five years of the advertising department of the New England Telephone and Telegraph Company, has accepted a position as special agent with the American Telephone and Telegraph Company in the comptroller's department. Mr. Owen was given a farewell dinner at the Exchange Club, Boston, on April 29, by his old associates.

JAMES GAYLEY, until recently first vice-president of the United States Steel Corporation, has been awarded the Elliott Cresson medal of the Franklin Institute of Philadelphia. This is the institute's most coveted prize, and was presented to Mr. Gayley in recognition of his invention of the dry air blast process, which has simplified and improved the manufacture of steel and iron.

RUSSELL F. BOWER, son of L. F. Bower, first vice-president of the Allis-Chalmers Company, was married on April 15 at Scranton, Pa., to Miss Margaret L. Kirkpatrick. Mr. and Mrs. Bower took a pleasant trip in the South, visiting Charleston, Augusta, Atlanta and Chattanooga, and are now at home at 225 Thirty-second street, Milwaukee. Mr. Russell Bower is in the engineering department of the Allis-Chalmers Company.

G. W. ARMSTRONG, the energetic western manager of the Excello Arc Lamp Company, returned to Chicago a few days ago from a four weeks' trip, the primary object of which was to obtain a much-needed rest. While Mr. Armstrong enjoyed the vacation to the fullest extent he could not refrain, with his customary enthusiasm, from presenting the merits of the Excello arc lamps to a number of users of arc lamps. As a consequence a few new users of "Excellos" were added to the company's list.

RICHARD T. LAFFIN has become associated with the Stone & Webster Management Association in connection with the Seattle Electric Company and other Puget Sound railway and lighting properties. Mr. Laffin was for many years connected with the Boston Elevated Railway, and was later general manager of the Worcester Consolidated Street Railway. He resigned from the latter position to become vice-president and general manager of the Manila Electric Railroad, and spent about four years in the Philippines in establishing and organizing the property, having only recently returned to this country.

WILLIAM J. CLARKE, of Mt. Vernon, N. Y., died at his residence on March 29 after a short illness. Mr. Clarke was born at Wenton, Canada, February 5, 1861. He displayed early inventive faculties, and after becoming a telegraph operator he was, in 1885, appointed manager of the Trenton Electric Light Company, a position which he held until 1890, when he became general manager of the Hamilton Electric Light Company, remaining in that capacity until 1894. Subsequently he went to Washington, D. C., afterward to Philadelphia, and later to New York, where he became sales agent for the Adams-Bagnall Electric Lamp Company. In 1898 he organized the United States Electrical Supply Company, and began the manufacture of wireless telegraph outfits, high-frequency apparatus, etc. About this time he became noted as a lecturer on wireless telegraphy, and on other similar topics. Mr. Clarke was associated with Marconi in reporting the International Yacht Races by wireless. He will be remembered by many in connection with his electrical lectures and demonstrations at the Madison Square Garden and Chicago Electric Shows in recent years. Mr. Clarke is survived by a widow, one son and a daughter.

INDUSTRIAL ITEMS.

THE CONSOLIDATED RAILWAY ELECTRIC LIGHTING AND EQUIPMENT COMPANY announces that the offices of its Chicago branch have been removed to 1720 Michigan Avenue.

HORSTMANN AND BERTHOLD, formerly of 192 South Jefferson Street, Chicago, have removed to more commodious quarters at 37-51 Monroe Street. The name of the firm has been changed to Electric Apparatus Company.

THE GREGORY ELECTRIC COMPANY, Chicago, Ill., has issued the May number of its "Bargain Sheet," a fifty-six-page booklet of second-hand but reliable electrical machinery and supplies. Copies may be had on application.

THE CRESCENT COMPANY, of Chicago, has removed to larger quarters at 106 South Clinton Street, where new facilities will enable the company to accommodate its rapidly increasing business and to make immediate shipments on all orders regardless of size.

THE NATIONAL ELECTRIC SUPPLY COMPANY, formerly at 115 Franklin Street, has moved to 328 and 330 West Lake Street, Chicago, where increased room and better facilities in general will enable it to provide for the wants of its patrons more satisfactorily for all concerned.

THE OHIO BRASS COMPANY, Mansfield, Ohio, has issued Catalogue 20, a handsome illustrated book of eighty-six pages on O-B catenary material. Besides illustrations and descriptions of the parts used in catenary construction and of the system as a whole the book contains useful notes on methods of installation and hints on general construction.

THE MARSHALL ELECTRIC COMPANY, Hyde Park, Mass., announces that T. I. Parker, who has been representing the Manhattan Supply Company for the past five years, is now their western sales agent and distributer, with headquarters at 120-122 Franklin Street, Chicago, where a good stock of Marshall sockets, pipe ends, and other specialties will be carried.

THE GREEN FUEL ECONOMIZER COMPANY, Matteawan, N. Y., has issued a pamphlet entitled "Automatic Draft Control for Steam-Boiler Furnaces," which describes an improved appliance for so regulating the draft of steam boilers that just enough pressure is supplied under the grates to force the air through the fuel, and enough draft is induced in the smoke flue to draw the gases of combustion through the boiler.

THE GARWOOD ELECTRIC COMPANY, Garwood, N. J., a new organization, has secured the exclusive right to manufacture the dynamos, motors and other appliances which were formerly manufactured by the C. & C. Electric Company. The new company has already begun business, and it will use the same factory, with the same designs, patterns and tools, and with the same engineering staff and workmen as the old C. & C. Company. The main office of the new corporation will be at the works at Garwood.

DEAN BROS., Indianapolis, Ind., manufacturers of steam pumps, have issued Catalogue 77, containing lists of parts of their pumps, with reference numbers corresponding to numbers on the numerous illustrations and diagrams. Directions for ordering parts, explicit instructions for erecting and operating the pumps, hints on hydraulics and steam engineering, and tables, etc., of useful miscellaneous information, make up the rest of the book, which is useful enough to be kept on file for reference purposes.

THE BIRD-ARCHER COMPANY, of New York, manufacturer of boiler compounds, has authorized the following new foreign agencies, to accommodate its increasing business: At Honolulu, J. P. Lynch, 42 Young Building; at Manila, Lambert Springer Company, 99 Plaza Santa Cruz; at Yokohama, T. M. Laflin, Exchange Market; at Hongkong, Shanghai and Singapore, United Asbestos Oriental Agency, Limited. Recent sales of the Bird-Archer compound in Japan, China and the Straits Settlements have been constantly on the increase in spite of strong European competition.

THE LORD ELECTRIC COMPANY, New York city, has issued Bulletin H on lightning-protection devices. This contains an article, "Lightning and How to Protect Against It," with especial reference to the Shaw lightning arrester, which is manufactured by the Lord Company, and which has been approved by the National Board of Fire Underwriters. Various types of lightning arresters are described and admirably illustrated. Other contents are: An article, "Grounds, and How to Secure Them," lists of grounding accessories, choke coils of various kinds, and diagrams showing methods of installing lightning arresters, etc.

THE CHASE-SHAWMUT COMPANY, of Newburyport, Mass., has published the opinion of the United States Circuit Court of the District of Massachusetts in the suit brought by the D. & W. Fuse Company against it for alleged infringement of Patent No. 640,371, issued to Mr. Downes for an improvement in electric fuses or cut-outs. In dismissing the bill, the opinion, which was filed February 19, 1909, holds that the only patentable feature in Downes' invention was his division of a single fuse link into multiple links, also that Downes had openly declared that filling such a fuse is altogether useless except in connection with an air space, but an air space is not found in the patent claim in suit nor in the defendant's manufacture.

THE SAMSON CORDAGE WORKS, Boston, Mass., manufacturers of solid braided cord, has celebrated its twenty-fifth birthday and is distributing to some of its friends a silver piece commemorating this anniversary. The company entered the braided cord business under the firm name of James P. Tolman in 1870. In 1884 the Samson Cordage Works was established by J. P. Tolman and Company. In 1888 the Samson Cordage Works was incorporated under the laws of Massachusetts, with James P. Tolman, president, and Herbert G. Pratt, treasurer. The company states that in 1909 it has in this direction the largest investment and largest production in the industry.

THE ALLIS-CHALMERS' COMPANY, Milwaukee, Wis., announces that during the past ninety days it has taken contracts for upward of thirty steam turbines and generators, aggregating in capacity nearly 50,000 kilowatts, and that negotiations are now pending for more than double that number. Among the orders recently placed are: A unit of 2,000 kilowatts for the Public Service Corporation of New Jersey, to be installed at Camden; another of 2,000 kilowatts, purchased by the Stone & Webster Engineering Corporation for the El Paso Electric Railway Company, El Paso, Texas, and a repeat order of a 2,000-kilowatt machine, to be placed in the public service station of the city of Columbus, Ohio.

DATES AHEAD.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., May 20-22.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual convention, Canton, Ohio, May 21-22.

American Association of Electric Motor Manufacturers. Annual convention, Hot Springs, Va., May 24-27.

West Virginia Independent Telephone Association. Annual convention, Parkersburg, W. Va., May 27-28.

National Electric Light Association. Annual convention, Atlantic City, N. J., June 1-4.

Association of Edison Purchasing Agents. Annual convention, Atlantic City, N. J., June 1-4.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June.

Canadian Electrical Association. Annual convention, Quebec, Canada, June 16-18.

Association of Railway Telegraph Superintendents. Next meeting, Detroit, Mich., June 23.

American Institute of Electrical Engineers. Annual convention, Thousand Islands, N. Y., June 28.

Ohio Electric Light Association. Annual convention, Toledo, July 13-15.

National Electrical Contractors' Association. Annual convention, Toledo, Ohio, July 21-23.

American Street and Interurban Railway Association. Annual convention, Denver, Colo., October 18-22.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) May 4, 1909.

920,107. APPARATUS FOR GLASS MANUFACTURE. Richard H. Bolin, Kane, Pa. Filed August 12, 1907. A motor-driven blower furnishes air to a blow-pipe for a glass furnace. A hoist for hoisting the blow-pipe into and out of the furnace automatically starts and stops the blower motor.

920,123. BURGLAR ALARM. William N. Fawcett, New York, N. Y., assignor of one-half to Marcus Bruckheimer, New York, N. Y. Filed July 31, 1908. Relates to an automatic switch in an alarm circuit.

920,124. ELECTRIC CLOCK-WINDING MECHANISM. Frank H. Feraud, Granite City, Ill. Filed September 8, 1908. The armature of an electromagnet actuates a pawl and ratchet wheel.

920,157. TOWER. John G. Kreer, Chicago, Ill., assignor to Joseph T. Ryerson & Son, Chicago, Ill. Filed September 12,

1908. A triangular steel skeleton transmission-line tower has secured near its top trussed steel cross-bars for supporting the wires.

920,159. TIMING DEVICE FOR EXPLOSIVE-ENGINES. Alexander Lamont and Lillion C. Steers, Detroit, Mich. Filed July 20, 1908. A roll on a pivoted arm is adapted to sweep over the contacts.

920,163. ELECTRIC PROGRAM-INDICATOR. Alphonsus Lonergan, New York, N. Y. Filed March 31, 1906. An electrically-illuminated sign with frosted-glass front.

920,169. CONNECTOR FOR CONDUITS FOR ELECTRIC WIRES. George E. Neuberth, Newark, N. J. Filed January 27, 1908. A two-part clamp has on one side a slotted lip and nose forming a hinge and at the other side a pair of wings bolted together.

920,179. ELECTRICAL KEY-SOCKET. Clarence D. Platt, Bridgeport, Conn. Filed September 16, 1908. Details of the key construction are disclosed.

920,183. ELECTRICALLY - CONTROLLED DOOR - OPERATING MECHANISM FOR STREET OR RAILWAY CARS. Harold Rowntree, Chicago, Ill., assignor to Burdett-Rowntree Manufacturing Company, Chicago, Ill. Filed September 20, 1906. The door-operating mechanism is prevented from opening the doors as long as the car controller is in any "on" position. The car controller is locked in "off" position till the doors are all closed.

920,192. TRANSMISSION MECHANISM. Benjamin F. Seymour, Denver, Colo. Filed May 9, 1908. Electrical means are provided to propel a conoidal transmission member longitudinally in relation to the shaft and to secure it at a selected point.

920,208. CIRCUIT-BREAKER. Lewis C. Steele, Columbus, Ohio. Filed August 16, 1907. The line conductors are connected by plugs to a tubular body pivoted on a binding plate.

920,215. LADLE OR DOUBLE-TROLLEY ELECTRIC CRANE. Clarence L. Taylor and Edgar E. Brosius, Alliance, Ohio, assignors to the Morgan Engineering Company, Alliance, Ohio. Filed February 21, 1908. The main trolley is mounted on divided main girders, each end of the trolley being supported at one corner on one section only of a girder and at its opposite corner on the other section only of the same girder.

920,220. ELECTRIC ARC LAMP. Christian J. Toerring, Philadelphia, Pa. Filed May 3, 1906. An inverted arc lamp has a fixed upper carbon-holder, a movable lower carbon-holder, a counterweight for the same and electromagnetic means for operating the clutch.

920,222. RECIPROCATING ELECTRIC MOTOR. Charles W. Tremain, Chicago, Ill. Filed April 14, 1908. An electric stamp mill consists of a pair of solenoids, links connecting the ends of a rocking lever with the cores, and a shifting fulcrum for the lever.

920,229. ELECTRICAL CURRENT CONNECTION FOR BOATS. Edmund Weström, Hamburg, Germany. Filed March 19, 1907. Canal boats are connected with a trolley wire resting on insulating wheels, with extended arms on top of posts along the shore. Contact is made through a ring encircling the trolley wire and connected with a tensioned cable passing to the boat.

920,257. SPARKING PLUG. Ralph C. Browne, Salem, Mass., assignor to Browne Apparatus Company, Salem, Mass. Filed April 25, 1903. A reversible plug has a pair of sparking electrodes at each end.

920,258. SYSTEM FOR TELEPHONE-TRUNKING. Sidney H. Browne, Pittsburg, Pa., assignor to American Telephone and Telegraph Company. Filed April 3, 1905. An automatic idle trunk-selecting switch is installed at each exchange.

920,259. CALL-DISTRIBUTING TELEPHONE-EXCHANGE SYSTEM. Sidney H. Browne, Pittsburg, Pa., assignor to American Telephone and Telegraph Company. Filed April 3, 1905. Relates to further details of the above. A line relay starts the automatic switch and a test relay stops it when its wipers make contact with an idle trunk.

920,261. HARMONIC BELL FOR TELEPHONES. William M. Bruce, Jr., Springfield, Ohio, assignor to the American Automatic Telephone Company, Rochester, N. Y. Filed September 11, 1907. The clapper is supported solely by a torsional rod connected with the magnet armature.

920,262. TROLLEY-WIRE HANGER. James Bryan, Pittsburg, and Harry Etheridge, McKeesport, Pa. Filed July 24, 1907. At each end of the hanger are flanges forming a crimp in oppositely disposed suspension wires.

920,269. TROLLEY-WHEEL HARP. William M. Caswell, Warren, Pa. Filed June 8, 1908. Has oil chambers and pockets in its forks for the bearing blocks.

920,277. TLEPHONE APPARATUS. John L. Creveling, New York, N. Y. Filed November 5, 1908. The ear-piece of a telephone receiver is connected by a sound duct with an auxiliary ear-piece applied to the listener's other ear.

920,278. ILLUMINATED SIGHT FOR FIREARMS. Emil O. Deere and Thure O. Jäderborg, Lindsborg, Kan. Filed February 11, 1909. At the end of the firearm is a shielded incandescent lamp.

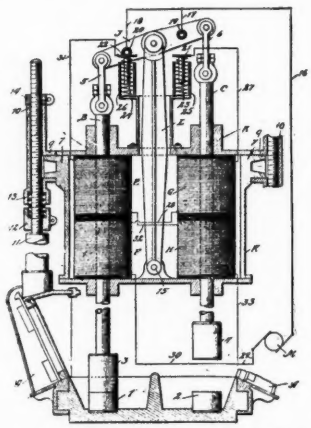
920,300. CONTROLLER-CHECKING DEVICE FOR STREET-RAILWAY CARS. Nathan Fallek, Denver, Colo. Filed June 15, 1908. A dog operated by projections on a ratchet wheel throws a pawl so as to successively engage the ratchet teeth and stop the wheel, and thus compels turning on the controller step by step.

920,326. SPARKING MECHANISM FOR AUTOMOBILES. George S. Hill, Bradford, Mass., assignor to Hill Motor Car Company, Haverhill, Mass. Filed November 20, 1905. Two tapering spiral cams are arranged to actuate two radially-moving plungers that close the sparking circuits.

920,331. ARC LAMP. Charles C. Hughes, Philadelphia, Pa. Filed April 13, 1906. Has a hot-wire regulating mechanism.

920,339. ELECTRIC-RAILWAY SYSTEM. Charles A. Huse and John G. Douty, Williamsport, Pa., assignors to Simplex Surface Contact Company. Filed September 17, 1907. A surface-contact system has its cars equipped with electromagnets adapted to operate the local switches installed in track boxes.

920,350. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM. Jacob W. Lattig, Wyncote, and Charles L. Goodrum, Philadelphia, Pa., assignors to the American Automatic Telephone Company, Rochester, N. Y. Filed September 16, 1903. The automatic switches at the exchange are controlled by a common battery through grounded circuits, although the talking circuits are all metallic.



920,222.—ELECTRIC STAMP MILL.

920,364. GROUND-WIRE ATTACHMENT. Charles W. Messner, Philadelphia, Pa. Filed February 26, 1908. A clamp encircling a grounded pipe has a flat extension, the outer end of which is formed into a sleeve with V-shaped solder-receiving openings for the wire.

920,378. ELECTRICAL SIGNALING APPARATUS. James D. Nelson, Cincinnati, Ohio. Filed May 4, 1907. Has a pole-changer for furnishing an undulating current adapted to open a circuit-breaker in each signal box when the box is pulled; this operation affects a magnet that stops the pole-changer so that it supplies only direct current.

920,401. OUTLET BOX. John N. Scism, Syracuse, N. Y. Filed February 12, 1908. Is provided with a diaphragm adjustable to different planes within the box and supporting the electric fixture, springs forcing the diaphragm and fixture toward the cover of the box.

920,424 and 920,425. TELEPHONE-TRANSMITTER. Ralph C. Browne, Salem, Mass., assignor to John Abbott, trustee, Winchester, Mass. Filed April 26, 1907. One electrode is circular, and between it and a central button electrode is a layer of variable resistance material.

920,427. TROLLEY. Henry Burkhard, Chicago, Ill., assignor of one-half to Harris Levinson and Jacob Fliegeltaub, Chicago, Ill. Filed August 1, 1908. The trolley harp has horns on each side.

920,431. TELEPHONE TRANSMITTER. Charles L. Chisholm, Marysville, New Brunswick, Canada. Filed January 8, 1907. A comparatively thick and rigid diaphragm has at its center a microphone having a contact pin, with a bearing surface of very small area directly engaging the diaphragm.

920,435. APPARATUS FOR SELECTIVELY AND AUTOMATICALLY ANNOUNCING THE APPROACH AND DESTINATION OF TRAINS TO A JUNCTION POINT. John P. Coleman, New York, N. Y., assignor to the Union Switch & Signal Company, Swissvale, Pa. Filed January 6, 1909. Along the track are located normally open circuit controllers for the indicators on the junction tower. These are actuated by electromagnets mounted on the axles of the train.

920,473. DISTILLATION FURNACE. Woolsey M. Johnson, Hartford, Conn., assignor to the Continuous Zinc Furnace Company, Hartford, Conn. Filed May 8, 1906. An electric furnace comprises a chamber with a vapor outlet and a casing of refractory material within the chamber and spaced therefrom, the electrodes being disposed at opposite ends of the casing.

920,485. MULTIPLE ARC LAMP. Wilhelm Mathiesen, Leutzsch-Leipzig, Germany. Filed October 31, 1906. A flaming arc has two pairs of converging electrodes and guides, in which the reserve electrodes snugly fit, so that their tips are protected from the fumes emanating from the arc struck between the electrodes in use.

920,487. SPEED-RECORDING DEVICE. Howard M. P. Murphy, Pittsburg, Pa. Filed April 16, 1908. A tape is geared to move at a speed proportional to the speed of the vehicle, and a clock mechanism records electrically seconds of time transmissions thereon, the tape being so ruled that the number of divisions between second marks indicates miles per hour.

920,490. PANEL-BOARD FOR ELECTRICAL POWER DISTRIBUTION. Arthur C. McWilliams, Chicago, Ill. Filed September 30, 1905. A three-wire distributing board has the meter circuits arranged in its upper portion and the branching circuits in its lower portion, vertical conductor bars connecting the latter with the meters interchangeably.

920,569. FLATIRON STOVE. Emery L. Hegarty and Henry L. Moody, Waterville, Me. Filed November 27, 1908. An electric flatiron is inverted in a block and on its pressing face is placed a round plate on which are put articles to be heated.

920,577. ELECTRIC SIGNAL FOR RAILROADS. Helena J. Jones and Frank T. Jones, Baltimore, Md. Filed October 1, 1908. There are two insulated rail sections at the entrance to each block and a signal device operated by an electromagnet through a contact plate adjacent the rail.

920,610. PROCESS AND APPARATUS FOR PRODUCING OXIDS OF NITROGEN BY MEANS OF A ROTARY FLAME. Ignacy Moscicki, Freiburg, Switzerland. Filed October 3, 1908. A step in the process consists in maintaining a flame between electrodes and introducing auxiliary cooling gases within the flame.

920,613. ELECTRIC SAFETY FUSE. Thomas E. Murray, New York, N. Y. Filed July 18, 1907. Surrounding an enclosed fuse is a body of inert and refractory material to retard the vibrations due to sudden shock of explosion and thereby to prevent rupture of the tube.

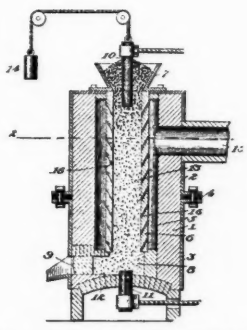
920,614. PERFORATED BLOCK FOR ELECTRIC CONDUCTORS. Frank R. McBerty, New Rochelle, N. Y., assignor to Western Electric Company, Chicago, Ill. Filed February 27, 1908. A terminal block has a series of grooves in one of its faces, a series of intersecting grooves in its opposite face, and a number of electrical terminals extending through the perforations produced by the intersections of the grooves.

920,623. CHANGEABLE-RATE ELECTRICITY METER. August Nicol, Berlin, Germany, assignor to Bergmann Elektricitatswerke Aktiengesellschaft, Berlin, Germany. Filed December 14, 1907. The rotary disk is capable of moving lengthwise on its shaft so as to change the speed of the recording mechanism.

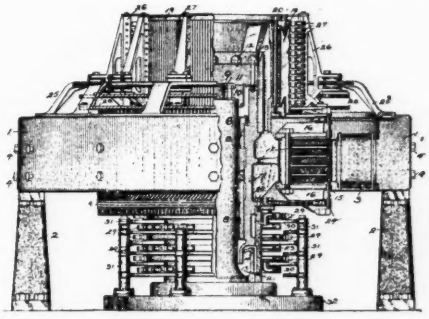
920,624. SOUND INTENSIFIER. Alexander Nikiforoff, Warsaw, Russia. Filed November 21, 1907. An intensifier for telephone circuits comprises a magnet system possessing concentric hollow poles and presenting a movable armature and a stretched wire loop carrying the same, and a microphone having a movable part bearing with an adjustable pressure against the armature.

920,626. DYNAMO-ELECTRIC MACHINE. Jakob E. Noeggerath, Schenectady, N. Y., assignor to General Electric Company, New York. Filed July 23, 1908. The collector rings and brushers of a unipolar generator have magnetic material in their composition and coils surrounding the path of a stray flux passing through the brushes.

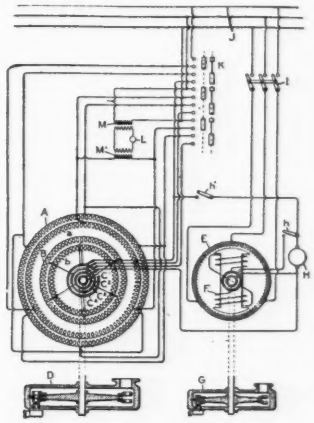
920,627. CURRENT-COLLECTING APPARATUS. Jakob E. Noeggerath, Schenectady, N. Y., assignor to General Electric Company, New York. Filed August 23, 1907. Relates to the construction of the brush-holder supporting bracket for a unipolar machine.



920,473.—DISTILLATION FURNACE.



920,845.—VERTICAL-SHAFT ROTARY CONVERTER.



920,809.—INDUCTION GENERATOR.

920,649. PROTECTION FOR ELECTRIC METERS. Guy R. Radley, Milwaukee, Wis. Filed November 8, 1905. Fuses are placed on the service and load sides of the meter, the latter being of such a size as to be blown first. A metallic case encloses the fuses.

920,652. TESTING APPARATUS. Forrest E. Ricketts, Baltimore, Md. Filed February 21, 1908. Includes a variable inductance, a transformer having its primary connected therewith, and a variable resistance in parallel with the primary.

920,654. RAILWAY SIGNALING SYSTEM. William G. Roome, Los Angeles, Cal., assignor to the Union Switch & Signal Company, Swissvale, Pa. Filed July 10, 1906. Track devices along a block system control automatic electric signals on the trains and at the dispatcher's office.

920,667. AUTOMATIC SWITCH. Adolph W. Schramm, Riverton, N. J., and Alfred E. Oswald, Philadelphia, Pa., assignors to Electro Dental Manufacturing Company, Philadelphia, Pa. Filed August 29, 1907. Consists of two members, one having means for maintaining it in one of two bowed positions, and the other being capable of moving the first member from one to the other position.

920,674. TROLLEY. John Shepherd, Chicago, Ill., assignor of one-half to John Shepherd, Chicago, Ill. Filed September 3, 1907. The harp is pivoted in a socket at the head of the trolley pole for slight sideward movements.

920,702. SPARK PLUG. Fred H. Weinhauer, New York, N. Y. Filed September 26, 1908. Means are provided for insuring perfect connection between a cable and a shell electrode.

920,709. ELECTROMAGNETIC GUN. Eli M. Alderman, Sharon, Pa. Filed June 8, 1908. A double-barreled gun comprises a series of electromagnets, each constituting a single section of each barrel.

920,710. SINGLE-PHASE MOTOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed December 26, 1907. A motor of the commutator type has inducing and exciting windings on the stator connected in series with each other and with main commutator brushes on the line of magnetization of the inducing winding, exciting brushes similarly related to the exciting winding, and a trans-

former having its primary in series with the main brushes and its secondary in series with the exciting brushes.

920,723. MAIL-POUCH RECEIVING AND DELIVERY APPARATUS FOR RAILWAY CARS. Chauncey W. Broughton, Carlton, Ill. Filed August 3, 1908. A pivoted support for a mail pouch upon a car has an electromagnet for holding it in its retracted position, a dog for locking it there and automatically breaking the circuit, a second electromagnet for releasing the dog, and means for alternately closing the circuits of the two magnets.

920,724. ELECTRICALLY-OPERATED STARTING DEVICE. Harold H. Brown, Boston, Mass. Filed July 27, 1907. Combined with an igniter and an electrically-operated valve for each cylinder is a distributor with a number of segments and means for connecting in multiple the igniter and the electric valve of each cylinder with one of the segments.

920,725. COOLING DYNAMO-ELECTRIC MACHINES. John G. Callan, Lynn, Mass., assignor to General Electric Company, New York. Filed April 23, 1906. A fan and curved reflector are provided for forcing air against the commutator.

920,745. ELECTROMAGNETICALLY OPERATED INTERRUPTER IGNITING DEVICE FOR EXPLOSION MOTORS. Gottlob Honold, Stuttgart, Germany. Filed August 7, 1906. An iron-clad electromagnet has its poles within the coil and a pivoted armature arranged to operate a movable electrode.

920,778. ELECTRICAL PROTECTIVE DEVICE. Charles A. Rolfe, Adrian, Mich., assignor to Rolfe Electric Co., Rochester, N. Y. Filed December 29, 1903. A reversible heat cartridge is provided with means whereby one operation places it in condition for operating in a reversed position.

920,782 and 920,783. INSULATED RAIL JOINT. Reuben W. Smith, Marietta, Pa., assignor to the Rail Joint Company, New York, N. Y. Filed January 13, 1908. There are separate discontinuous joint bars for each rail, each having a longitudinal splice arm coupled to the adjacent joint bar and means for insulating the rails from each other.

920,786. ELECTRICAL APPLIANCE. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. Filed February 25, 1908. A porcelain receptacle has grooves on its outer surface for receiving wood screws.

920,798. MEANS FOR COOLING ELECTRIC MOTORS. John B. Wiard, Lynn, Mass., assignor to General Electric Company, New York. Filed February 23, 1907. The rotor of an induction motor has hollow conductors and a blower arranged to force air through them.

920,801. INSULATED RAIL JOINT. Benjamin Wolhaupter, New York, N. Y., assignor to the Rail Joint Company, New York, N. Y. Filed April 24, 1907. A two-part-base rail joint comprises opposite side joint bars, each of which is provided along one end with an integral base section for supporting one of the rail ends, and at a central point with an integral dependent reinforcing girder and with insulating means.

920,809. INDUCTION GENERATOR. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company, New York. Filed August 3, 1907. The method of putting into circuit an induction-generator consists in connecting it as a synchronous machine with direct-current excitation and half its normal number of poles, synchronizing it with the busbars, and then connecting it to the busbars as an induction machine with its normal number of poles.

920,827. ELECTRIC-LIGHTING SYSTEM. John L. Creveling, New York, N. Y., assignor to Safety Car Heating & Lighting Company. Filed May 28, 1908. A voltage-regulator for an axle train-lighting system has one magnet connected in series with the generator and another across the storage battery.

920,833. SYSTEM OF TELEGRAPHY. Robert L. Dean, Kansas City, Mo., assignor to Dean Rapid Telegraph Co. Filed April 5, 1906. The transmitter consists of a pair of reversely-driven worms, a contact maker and breaker, a shifting nut carried thereby, and means for actuating a shifting lever so that it will alternately throw the shifting nut into engagement with the worms.

920,843. ALTERNATING-CURRENT MOTOR CONTROL. Friedrich Eichberg, Berlin, Germany, assignor to General Electric Company. Filed October 26, 1906. Consists in employing as rotor terminals at starting, brushes displaced from each other less than 180 electrical degrees, and in employing, as terminals for running, brushes displaced from each other by 180 electrical degrees.

920,845. DYNAMO-ELECTRIC MACHINE. William L. R. Emmet, Schenectady, N. Y., assignor to General Electric Company. Filed November 22, 1907. A rotary converter has a stationary vertical shaft, a thrust block on its top, a second thrust block bolted to the hub of the armature spider and co-operating with the upper block, and a guide bearing carried by the hub and engaging the shaft.

920,846. DYNAMO-ELECTRIC MACHINE. Hermann F. T. Erben, Schenectady, N. Y., assignor to General Electric Company, New York. Filed February 1, 1907. The end plate for the rotor of an induction motor has a cylindrical flange projecting from its outer edge, the edge being slotted at numerous points to break its conductive continuity, the slots being arranged in planes parallel to the axis of the rotor and extending radially therefrom.

920,853. ARC-LAMP HEADLIGHT. Richard Fleming, Lynn, Mass., assignor to General Electric Company, New York. Filed May 6, 1905. Relates to the construction of a parabolic reflector through which pass the arc-lamp electrodes and around whose arc focus is a glass globe.

920,861. RESISTANCE MATERIAL. Henry Geisenhöner, Schenectady, N. Y., assignor to General Electric Company, New York. Filed February 3, 1908. A steam-hardened compound of comminuted aluminum with silica and a hydrate.

920,886. POLE PIECE FOR DYNAMO-ELECTRIC MACHINES. Louis E. Underwood, Lynn, Mass., assignor to General Electric Company, New York. Filed January 11, 1908. The main body of the pole is cast integral with the yoke and the pole pieces are laminated.

920,893. ART OF EXTRACTING ALUMINUM AND OTHER METALS. Henry S. Blackmore, Mount Vernon, N. Y. Original application filed September 12, 1903. Divided and this application filed July 31, 1907. Consists in maintaining the fusing of the substances by the action of an alternating current and in liberating the desired metal therefrom by the action of a direct current.

920,896. ALTERNATING-CURRENT MOTOR. Ernest F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company, New York. Filed May 19, 1906. A multipolar motor has a rotor with a number of wave windings connected to successive commutator segments, each winding having a coil pitch exactly equal to the distance between poles.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 12, 1909:

474,355. ELECTRIC RAILWAY. C. H. Baker, Lake Geneva, Wis.

474,388. DYNAMO-ELECTRIC MACHINE OR MOTOR. C. D. Jenney, Indianapolis, Ind.

474,398. ELECTRICALLY HEATED VESSEL. W. Mitchell, Malden, Mass.

474,454. EXCITING FLUID FOR GALVANIC BATTERIES. C. Lutcke, Jr., Berlin, Germany.

474,469. LIGHTNING ARRESTER. M. Dickerson, Fort Wayne, Ind.

474,468. ELECTRIC CONDUIT. A. Bruner, Indianapolis, Ind.

474,472. CLEANING BRUSH FOR ELECTRIC RAILWAYS. R. M. Hunter, Philadelphia, Pa.

474,473. ELECTRIC SNAP SWITCH. G. E. Hutchins, Baltimore, Md.

474,523. ELECTRICAL INDICATOR. J. W. Gibboney, Lynn, Mass.

474,528. LOCKING DEVICE FOR SWITCH AND SIGNAL-OPERATING MECHANISM. T. H. Patenall, Rahway, N. J.

474,541. ELECTRIC SWITCH. C. A. P. Willing and R. J. G. Violet, Berlin, Germany.

474,542. THERMOSTAT. A. H. Brintnell, Toronto, Canada.

474,552. TROLLEY FOR ELECTRIC RAILWAYS. C. E. Friel, Boston, Mass.

474,584. CONNECTION FOR ELECTRIC CONDUCTORS. C. W. Tobey, New Bedford, Mass.

474,600. COMMUTATOR BRUSH. R. Hirsch and H. Meminger, Milwaukee, Wis.

474,623. CIRCUIT CONTROLLER FOR ELECTRIC MOTORS. W. S. Andrews, New York, N. Y.

474,624. DYNAMO-ELECTRIC MACHINE. J. D. F. Andrews, London, England.

474,632. ELECTRICAL SWITCHBOARD. L. A. Fehr, New York, N. Y.

474,667. ELECTRIC LAMP SOCKET. W. D. Kurz and H. Amundson, La Crosse, Wis.

474,670. AUTOMATIC FIRE ALARM. M. Martin, Malden, Mass.

474,673. ELECTRIC HEAT ALARM. J. Meyer, Jersey City, N. J.

474,735. ELECTRIC WIND-VANE INDICATOR. H. J. Haight, New York, N. Y.